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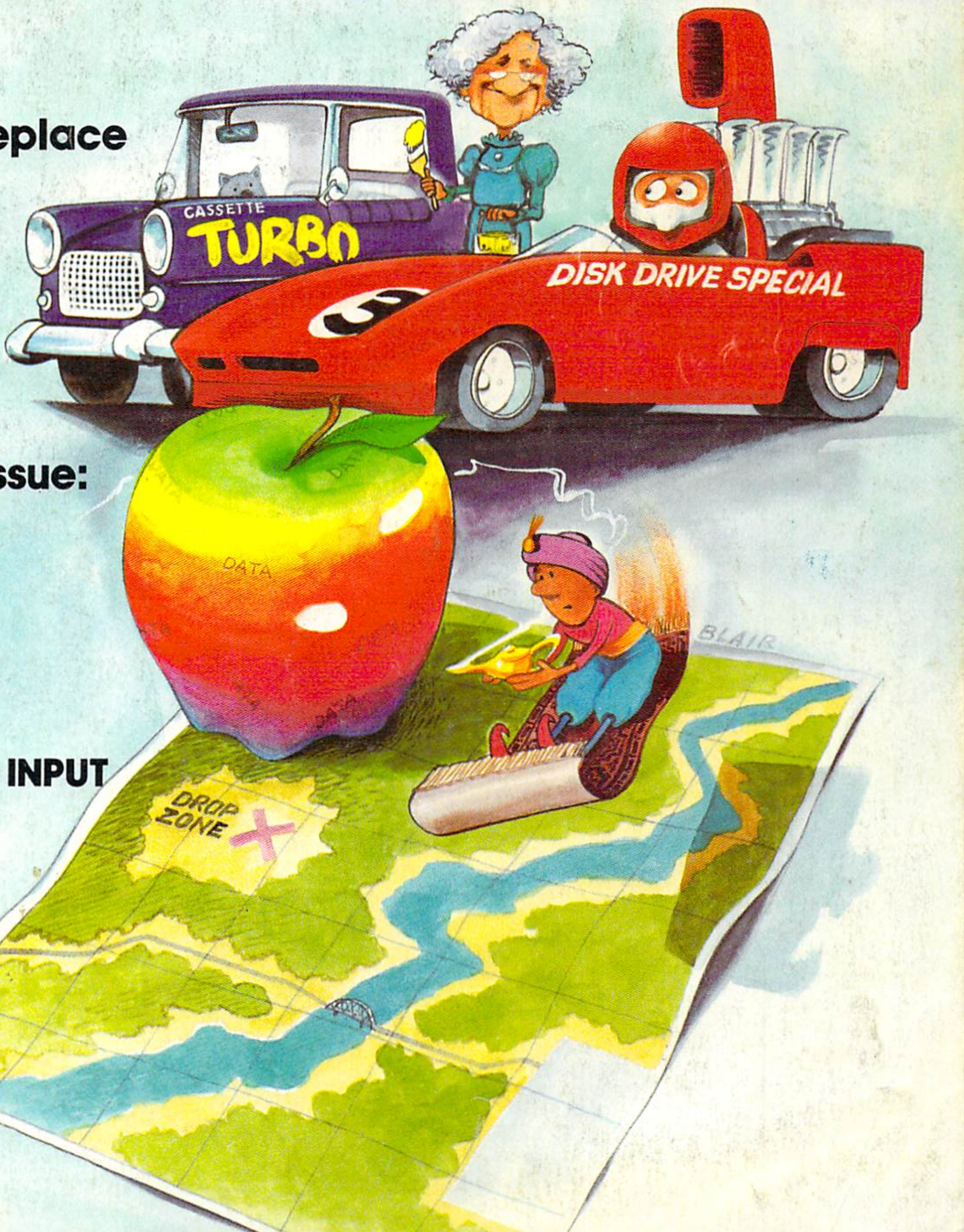
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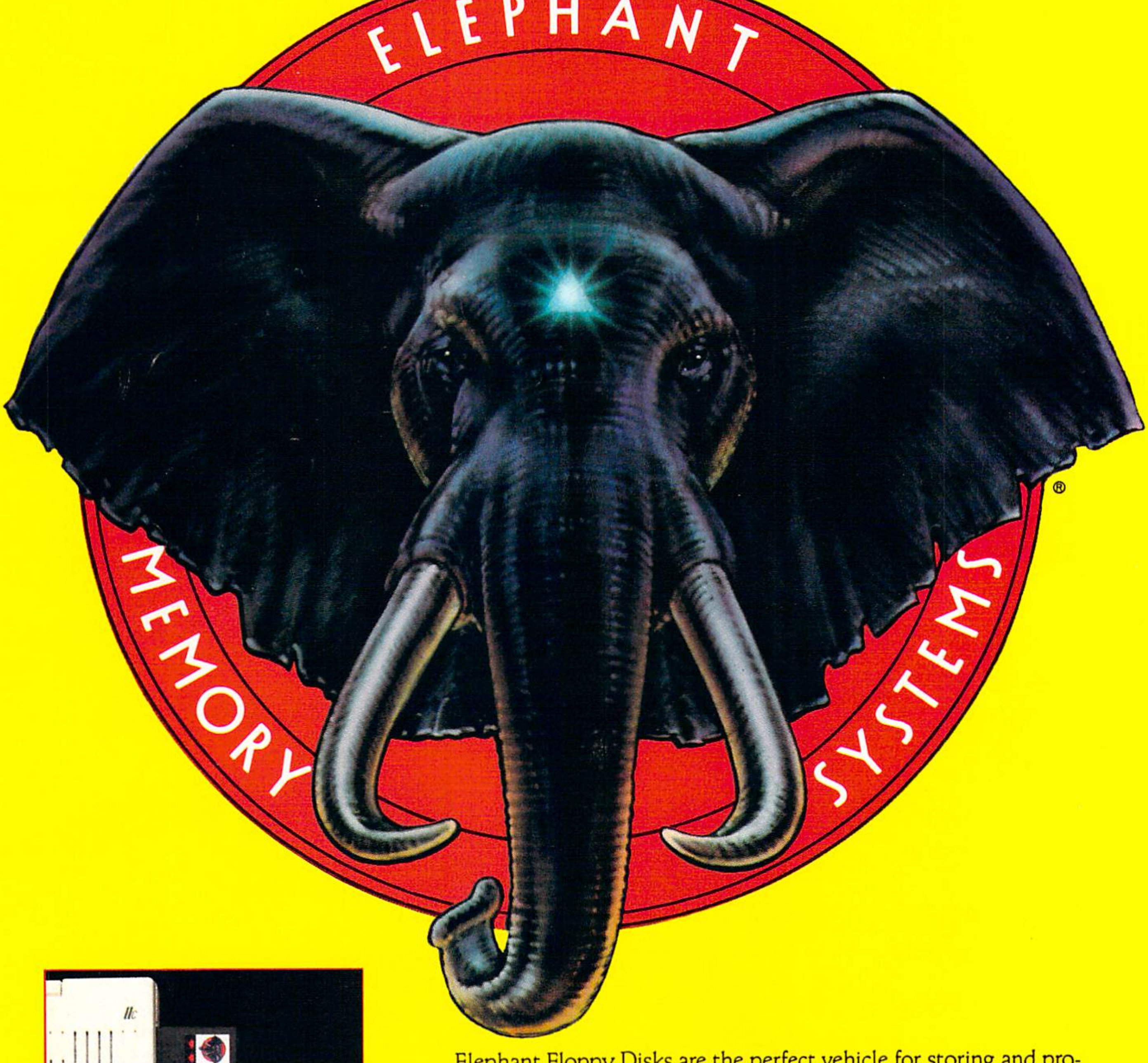

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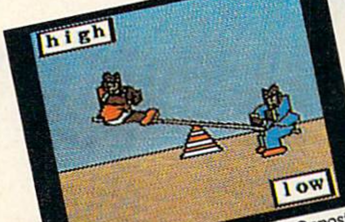

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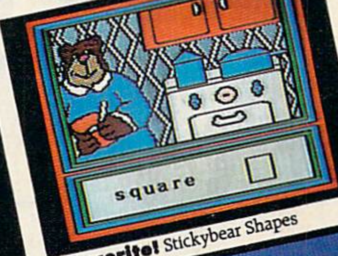

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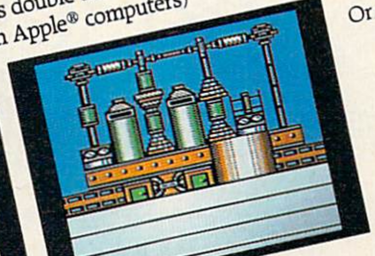

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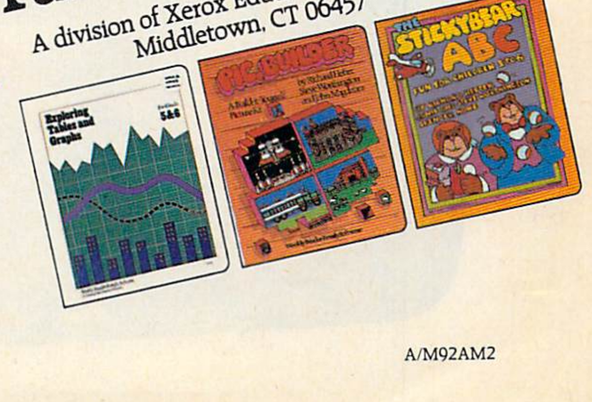

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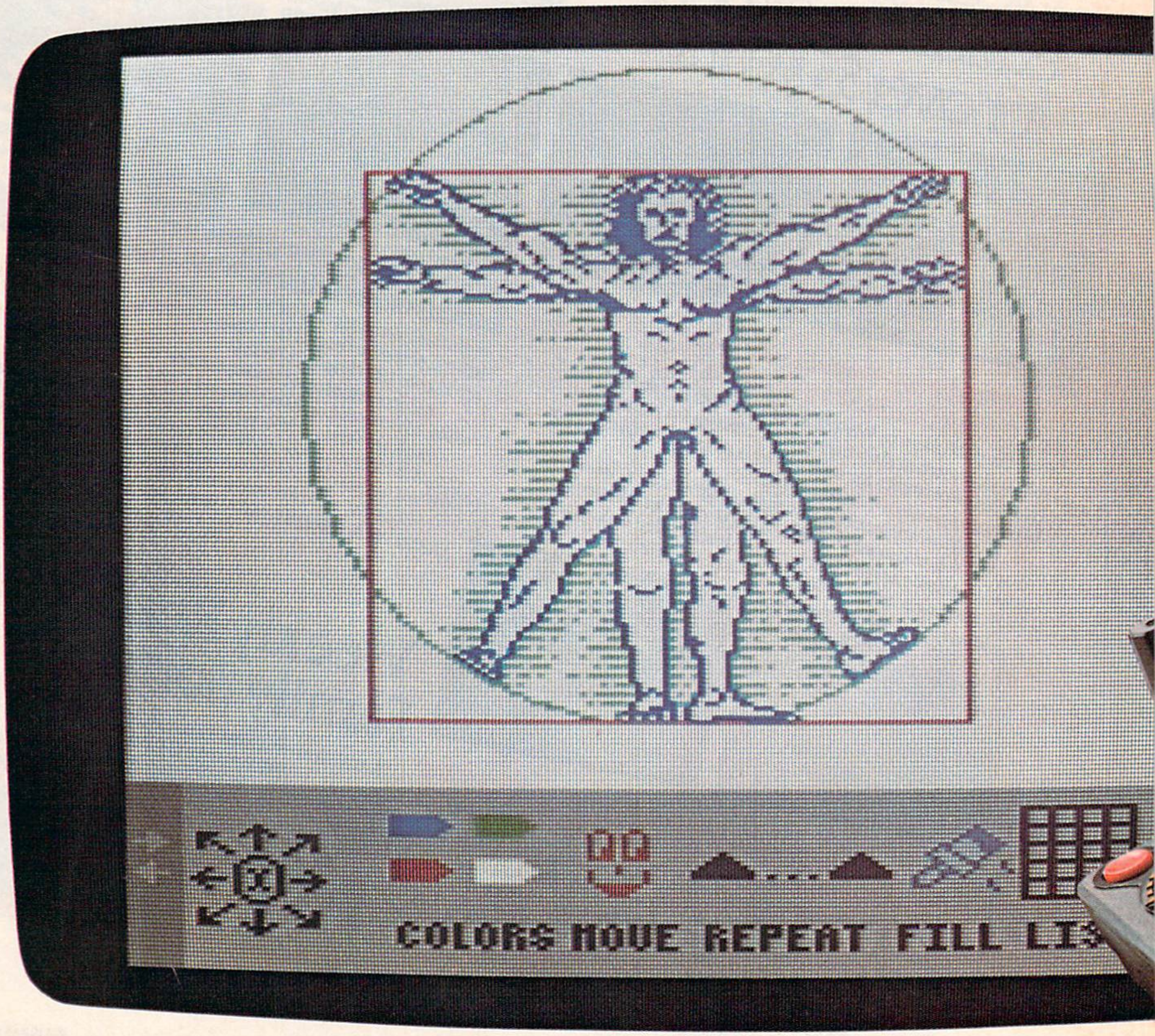
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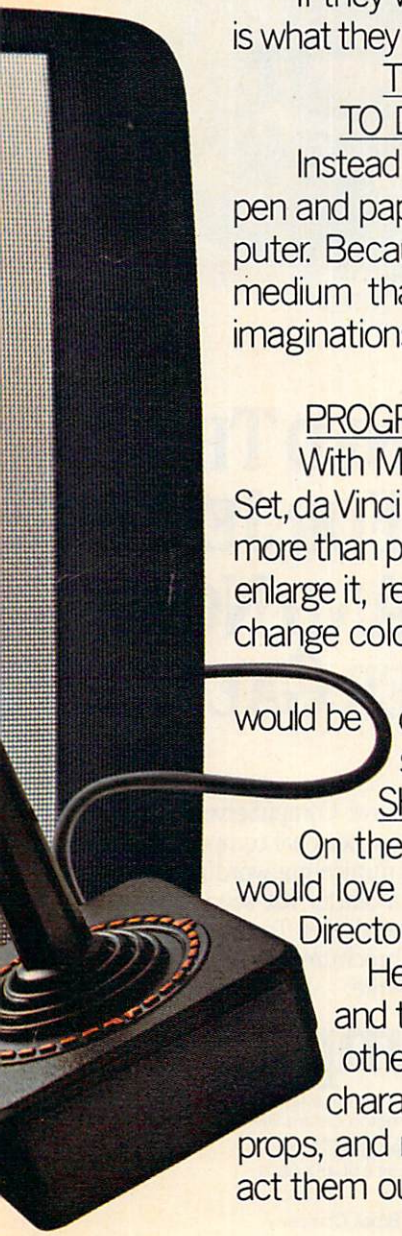

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EDITOR'S NOTES

This month's notes are written by Tom R. Halfhill, Editor of COMPUTE!.
—Robert Lock, Editor In Chief

Home Computing: 1985

This issue goes to press in early November, but it will be Christmastime when it hits your doorstep. In a few weeks, soon after New Year's, the Winter Consumer Electronics Show (CES) will get underway in Las Vegas. If you've been a regular reader of COMPUTE! for the past few years, you probably know that the biannual CES is a critically important trade show for the electronics industry. For the home computer industry, this year's Winter CES is particularly important.

To begin with, it's the first CES since the so-called shakeout began in earnest. More than a few companies will be missing from the show floor. Others will have smaller exhibits or will be hanging on for dear life.

More than that, this CES marks a turning point for the home computer industry. We will probably witness the first new home computers introduced for almost five years.

How's that again? Haven't there been dozens of home computers introduced at these shows? Enough to inspire a Defunct Home Computer Edition of *Trivial Pursuit*? Yes, but . . . .

For what's supposed to be an exciting, fast-moving, high-tech industry, the home computer market has been pretty boring. Sure, there have been price wars and rumors of wars, soaring success stories, bankruptcies, ironic turnabouts, and many other wonders. But these were all marketing developments. It's been years since a *really* technologically new home computer was introduced. The Commodore 64, which hit the market with its multicolor sprite graphics and synthesizer chip in August 1982, was arguably the last one. Everything introduced since then has been either a step backward, a step sideways, or a very, very small step forward. And even the Commodore 64 had much in common with the Atari 800, introduced way back in 1979.

Not that we're singling out home computers. In personal computing in general, you could argue that the only real groundbreakers introduced in the past five years were the Osborne 1 (the first transportable) and the TRS-80 Model 100 (the first portable). It's still a little early to determine if the Apple Macintosh will turn out to be revolutionary or evolutionary.

Fortunately, the upcoming CES should unveil the next generation we've been waiting for: home computers that will finally reach beyond 1970s' technology. Both Commodore and Atari are rumored to be preparing incredibly powerful home computers that will even outclass many of the business-oriented personal computers now in use. Sinclair is already starting to sell a computer that offers more raw computing power for $500 than a $4,000 IBM PC-XT. For marketing and other reasons, some of these computers may fail to catch on. But they signal the future. These computers or others like them will dominate the rest of the 1980s.

Could this be the shot in the arm that the home computer industry seems to need?

Perhaps. Today's eight-bit, 64K home computers can already do more than enough for many people. But after several years of marketing revolutions, it'll be a relief to see some true technological advances for a change.

COMPUTE!: 1985

As usual, we'll be on the scene at the Winter CES to bring you a full report. We'd also like to mention some of the other coverage we have planned for you in 1985.

Some valuable software is in the works—and it's free for the typing. In this issue, among other things, you'll notice "TurboTape," a deceptively simple utility which makes Commodore 64 and VIC-20 tapes load as fast as disks (really), and "JTERM," a quality terminal program for Atari computers. But that's just the beginning.

Next month, 64 and VIC users can look forward to "Plus/Term," a topnotch terminal program written mainly in machine language. It even allows uploading and downloading and has 80-column capability. Some great games are scheduled, too, including "Acrobat" for Commodore and Atari computers and the all-ML "Rebound!" for the IBM.

But our most exciting announcement is the upcoming *SpeedScript 3.0* series. Some Commodore readers are familiar with *SpeedScript*, the all-ML word processor we published last year for the VIC and 64 in our sister magazine, COMPUTE!'s GAZETTE. To put it mildly, it was the most popular program ever published by COMPUTE! Publications.

Starting in early 1985, we'll debut *SpeedScript 3.0*, a new and improved version. *SpeedScript 3.0* will be published for the Commodore 64, VIC-20, Atari, and Apple II-series computers. Each version will be written entirely in machine language with special features optimized for each computer. And each version will be yours for the price of a single issue of COMPUTE!.

For various computers, we're also working on a Tiny BASIC Compiler that will significantly speed up your BASIC programs, a utility that lets you create your own animated cartoons, and much, much more.

We hope you'll join us in 1985 for what promises to be an exciting year for home computing and COMPUTE!.

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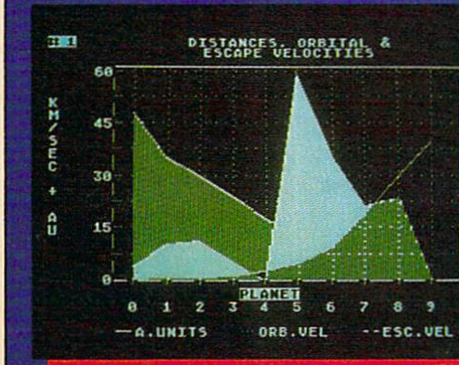
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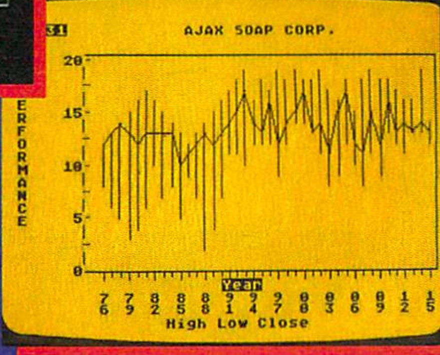
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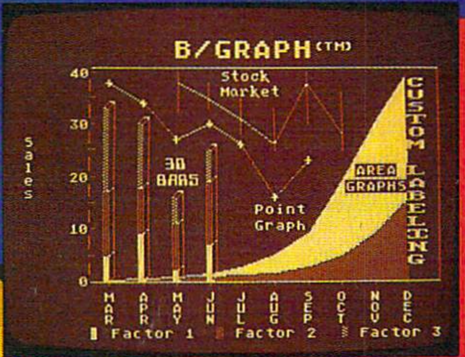
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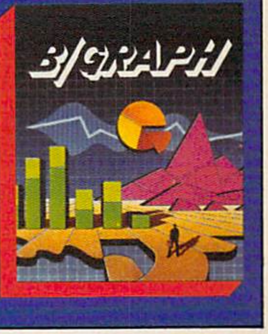

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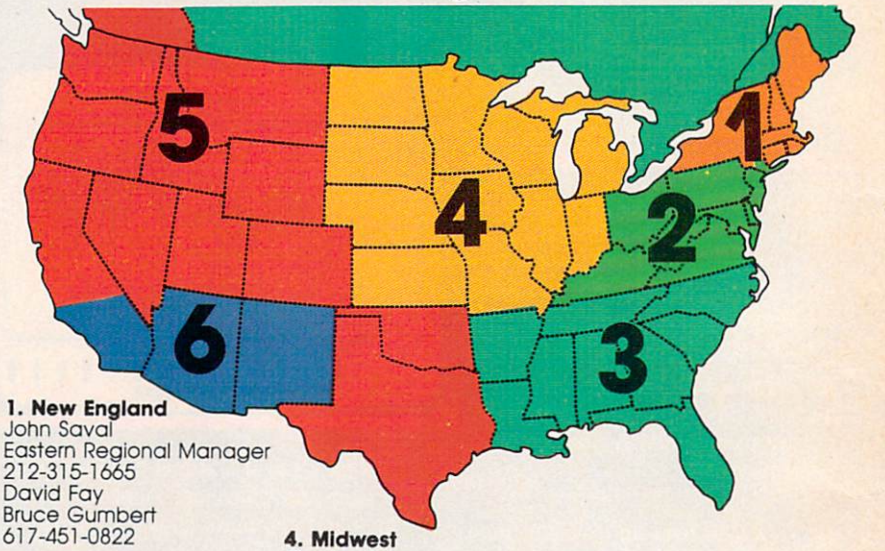

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READERS' FEEDBACK

The Editors and Readers of COMPUTE!

Keep It On The Ground

I own an Apple II Plus with a three-prong power plug. My house has only the older two-prong outlets. Is it safe to use a three-prong to two-prong adapter, or should I use a spike protector?

Ralph Pepe

Although using a two-prong adapter on a grounded, three-prong plug is defeating a potentially valuable safety feature, many people who—like you—have only the older outlets use them without incident. Adding a spike protector may defend your computer against voltage transients and surges, but it will not provide additional protection against shock hazard in the event of a short circuit, which is the purpose of the grounded prong on the plug.

One alternative is to attach the ground wire provided on some two-prong adapters to the faceplate screw in the center of the outlet. Before you count on this, make sure the outlet box itself is grounded. In some older homes, this may not be the case. To insure safety, it may be necessary to run a separate line for grounding. Contact a qualified electrician.

One additional note: A water pipe may not be a good ground, especially if a water meter is attached in-line in your basement. The meter may contain plastic pipe, insulating the house side from ground.

Atari Player/Missile Graphics

I have an Atari 600XL and would like to know what player/missile graphics are and how they work.

Ronald Mickle

Player/missile graphics *is the Atari term for* sprite graphics *as found on the Commodore 64, TI-99/4A, and Coleco Adam computers. Player/missile or sprite graphics is a built-in hardware feature designed to make it easier for programmers to create and move shapes on the screen quickly and smoothly.*

First, some background. There are four ways to achieve animation on computers: character graphics, bitmapped graphics, screen flipping, and sprite graphics. Character graphics is the simplest method; sprite graphics (including player/missile graphics) is the most advanced.

Practically all computers can use character graphics. Basically you just print a character on the screen, erase it, then print it again at the next position, so the character appears to move across the screen. On some computers you can redesign the character into any shape you want, so the letter A can become a spaceship or an alien creature. Character graphics are relatively easy to program, even in BASIC. But there are two drawbacks. Because the object is moving by one character position at a time, the animation looks rough and jerky. Plus, the moving character erases any other characters it passes over, unless your program reprints the erased character in its original position.

Another approach is bitmapped graphics, the most common technique used on computers like the Apple and IBM. Images are drawn on the screen (mapped) by copying patterns of bits stored in RAM. To move an object, a program must move the pattern of bits through memory. This technique is much more difficult than character graphics. In fact, it's virtually impossible without using machine language. The program must keep track of the current address of the bit pattern, erase the pattern, calculate the new addresses for the pattern, and finally recreate the pattern at the new addresses. Although the animation is smooth, so many calculations are required that you're usually limited to moving a relatively small number of objects.

With screen flipping, you draw a series of screens, each slightly different from the previous one, and store them all in memory. By instantly flipping between the screens, you simulate animation in the same way a cartoonist does with a sequence of frames or cells. The problem with screen flipping is that it requires vast amounts of memory. Also, some computers don't have built-in provisions for instantly flipping screens.

Sprite graphics are similar to bitmapped graphics, except the computer does most of the tedious

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calculating for you. In addition, the image of the sprite pattern is superimposed on the video output of the computer, so the pattern is not actually moved through memory. That means a sprite can seem to move above or beneath other screen images—including other sprites—without disturbing them. What's more, the computer knows when a sprite is touching another object. That's important if you're writing a game, because your program can keep track of these collisions and respond accordingly.

You probably won't find any mention of Atari player/missile graphics in the manuals which came with your 600XL. In fact, player/missile graphics was an undocumented feature when the Atari computer first hit the market in 1979–1980. The first article revealing its existence—written by Atari programmer Chris Crawford—appeared in the January 1981 issue of COMPUTE!. *This issue is out of print, but the article is reprinted in* COMPUTE!'s First Book of Atari. *More detailed information on programming player/missile graphics can be found in* COMPUTE!'s First Book of Atari Graphics *and* COMPUTE!'s Second Book of Atari Graphics.

Future Of The VIC

Will Commodore discontinue the VIC-20? And if so, will the company still make software and hardware for the VIC-20s that are out there?

Paul Fowlie

The Commodore 16, announced in January 1984 and first marketed in October, replaces the VIC-20 as Commodore's entry-level home computer. By last June Commodore had stopped producing the VIC. Although more than two million VICs have been sold worldwide, Commodore obviously feels that the $100 Commodore 16 is a better value for beginners and also helps promote the company's marketing strategy. The Commodore 16 is essentially a Plus/4 with 16K instead of 64K RAM and no built-in software or modem port. It is upwardly compatible with the Plus/4, not true with the VIC and the Commodore 64.

As early as the Winter Consumer Electronics Show (CES) in January 1984, it was apparent that fewer companies were producing software for the VIC. There was even less software at the Summer CES in June. This doesn't mean that everyone is abandoning the VIC overnight. The installed base is still very large. But it will become increasingly difficult to find new products aimed at the VIC-20—and that includes products from Commodore. Because the peripherals are largely compatible, many people have upgraded from the VIC to a 64.

One high-ranking Commodore executive told us that if someone wants to buy a hundred thousand VIC-20s, Commodore could sell them. In other words, there are plenty of VICs still around, but the company is not planning to market them in competition with its own new machines. The same official told us, however, that owners of VICs who need help will be supported by Commodore. "We have spares. We have everything. If people have a problem, we will fix it, repair it—no problem."

COMPUTE! *will continue covering the VIC-20 as long as there is sufficient reader demand. There are still many thousands of VIC users among our readers.*

TI Peripherals

I noticed an inquiry in "Readers' Feedback" in the October 1984 issue of COMPUTE! regarding the availability of the Peripheral Expansion System and its associated plug-ins. Texas Instruments has a toll-free number (1-800-842-2737) for TI users with questions about product availability.

TI also has a list of third-party suppliers available. Some of them even make products that TI never got around to offering.

Randall L. Powell

Thanks for the information. We received numerous letters informing us of various third-party suppliers for TI peripherals, including alternate expansion systems, peripherals that work without any expansion system, and even leftover supplies of TI's own expansion box and cards. These are available mainly through mail-order outlets. In most areas it has become impossible to find any peripherals for the TI-99/4A in local stores.

Tamea Rector, advertising/marketing director of Tenex Computer Express, also sent us a copy of the company's 48-page catalog of TI products. To get a free copy, write to:

Tenex Computer Express
P.O. Box 6578
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Cool Computing

I own a Commodore 64, and when I use it for a long time—mostly in the summer—funny-looking waves appear on the screen and scroll downward. After that, the waves get bigger and bigger, the computer starts printing characters all over the screen, and the keyboard won't operate. Is there any way to stop these annoying waves?

Paul Mantsch

It sounds like a classic case of overheating. Computer chips are designed to operate within a specified range of temperatures. For example, the VIC-II video chip in your 64 is rated to function normally between 32° and 158°F (0°–70°C). At the high end of their rated ranges, chips can start acting

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strangely, and if a particular chip isn't quite up to specs, the bizarre behavior can begin to show up at lower temperatures. While it's unlikely that your room temperature is reaching 150°, it could get that hot inside the computer's plastic housing, since all chips emit heat as they operate.

There are a couple of possible solutions. First, make sure the ventilation slots on the underside of the computer and the expansion slots on the back panel aren't obstructed. If that's no problem, perhaps you can set up a table fan to keep air circulating over the computer on hot summer days (it'll help keep you cool, too).

Still no results? A more drastic solution is to remove the foil shell which covers the circuit boards of newer 64s. The foil is designed to reduce RF (Radio Frequency) interference, but it also traps heat. Carefully remove the foil shell and see if this solves the problem. (Unfortunately, removing the foil voids your warranty and may also cause more video interference with nearby TV sets.)

Another alternative is to have your computer checked out by a qualified service technician. Perhaps a slightly defective chip is responsible for the overheating.

Named Subroutines In Microsoft BASIC

Microsoft BASIC supports named subroutines. Sort of. The following construction is legal:

```
GOSUB1200, EVALUATE:IF X=0 THEN PRINT
"WHOOPEE!!"
```

After executing the GOSUB, BASIC returns to the end of the GOSUB line number and looks for the next colon or the beginning of a line. All else is ignored.

This is more useful than a REM, since you can place additional statements on the same line and it saves a byte of memory. It works on the Commodore PET, 64, and VIC computers.

Bill Baldock

Thanks for the tip. This may also work with other machines using Microsoft BASIC, but try it out before embedding it in a crucial program.

Storing Text On Disk

Can a disk drive store text by page?

John B. Gentilucci

Disk files can contain any information you want. However, trying to store a text file by pages would be a time-consuming and inefficient use of disk space. Most word processors allow you to set up limits for page size and also will automatically paginate the printout. You'll find it much easier to store files by chapter or subheadings, and let your computer keep track of the pages when printing the text. This way you'll also be able to make revisions without restructuring your files because of a change in page sizes.

Reading TI Joysticks

I built the joystick adapter presented in "Readers' Feedback" of the August 1983 issue for my TI-99/4A and revised it as suggested in a later issue. I have several questions about the use of joysticks with the TI. First, how do you detect when the fire buttons are being pressed? And second, how do you achieve simultaneous joystick movement?

Matt Phillips

The fire buttons are detected with the CALL KEY statement on the TI. The format is:

```
CALL KEY(unit,key,status)
```

where unit is 1 or 2 for the joystick number. When a fire button is pressed, KEY takes on a value of 18. Ordinarily the key value is 0.

You can also detect firing with the STATUS variable. The STATUS variable can have a value of 0, −1, or +1. STATUS is 0 if the fire button is not pressed, −1 if the fire button is still being pressed since the last CALL KEY, and +1 if the fire button was not pressed at the last CALL KEY, but is presently being pressed.

There's no such thing as true simultaneous joystick movement on the TI or any other computer. Instead, you create the illusion of simultaneity by alternately checking the joysticks very quickly. The following sample program demonstrates one method of doing this and also illustrates use of the fire button. This program lets you move two figures around the screen with the joysticks. Joystick 1 moves a stick man figure, while joystick 2 moves a ball-shaped figure. Pressing the fire button changes the color of the respective figures.

```
10 REM TWO JOYSTICK DEMO
20 CALL CHAR(47,"1818423C183C4242")
30 CALL CHAR(48,"003C7E7E7E7E7E3C")
40 X(1)=15
50 Y(1)=11
60 Y(2)=11
70 X(2)=17
80 C(1)=13
90 C(2)=14
100 CALL COLOR(2,C(1),1)
110 CALL COLOR(3,C(2),1)
120 CALL CLEAR
130 CALL SCREEN(15)
140 FOR I=1 TO 2
150 CALL JOYST(I,DX,DY)
160 CALL KEY(I,K,S)
170 IF K<>18 THEN 200
180 C(I)=C(I)+1+(C(I)=16)*15
190 CALL COLOR(I+1,C(I),1)
200 CALL HCHAR(Y(I),X(I),32)
210 X(I)=X(I)+DX/4
220 Y(I)=Y(I)-DY/4
```

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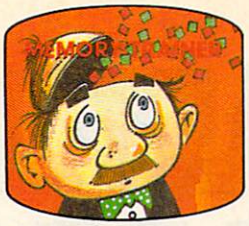

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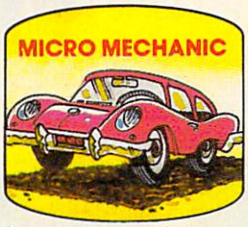

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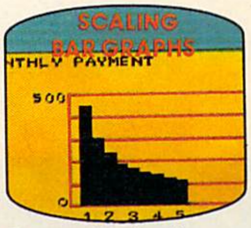

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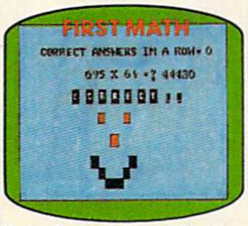
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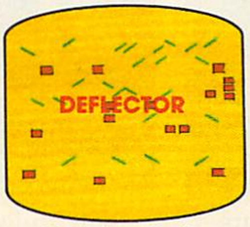

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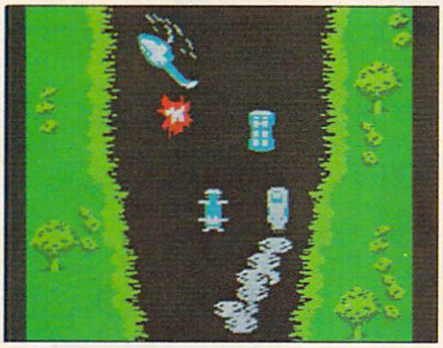

Bally Midway's Spy Hunter puts you in the driver's seat of the hottest machine on four wheels. You're after enemy spies. The situation is life and death. You'll need every weapon you've got – machine guns, and guided missiles, oil slicks and smoke screens. But the enemy is everywhere. On the road, in the water, even in the air. So you'll have to be more than fast to stay alive in Spy Hunter. You'll need brains and guts, too.

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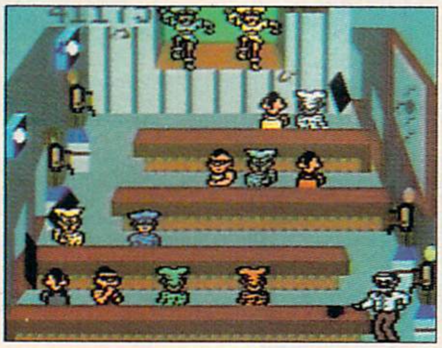

Bally Midway's Tapper would like to welcome you to the fastest game in the universe.

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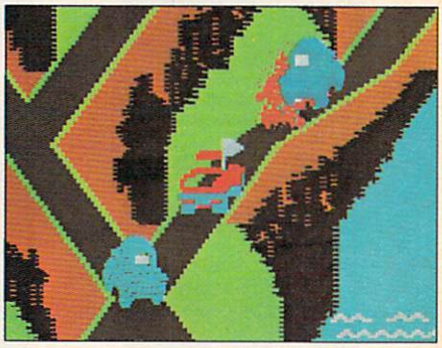
Are you fast enough to play Tapper? If you have to ask, you probably already know the answer.



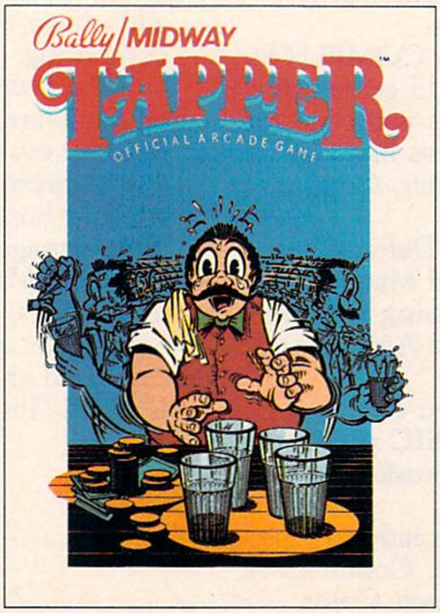
Bally Midway's Up 'N Down by Sega. In this game, a crash is no accident.

In fact, it's the whole object of the game. You'll race your baja bug over some of the worst roads south of any border. Leap dead ends, gaping canyons and oncoming traffic in a single bound. And if anyone gets in your way, crush 'em.

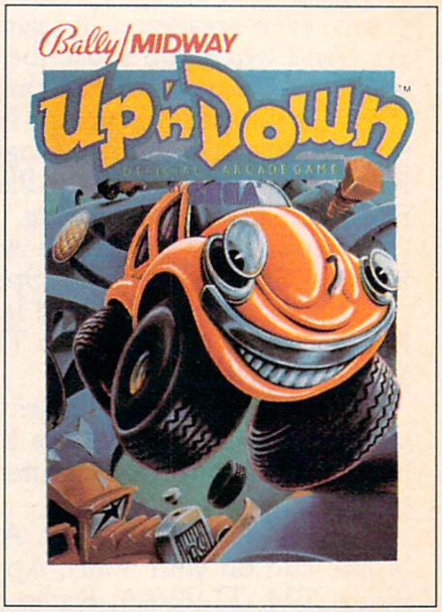
Crashing, bashing Up 'N Down. It's one smash hit that really is a smash.

Bally/MIDWAY
SPY HUNTER™

The #1 Arcade Game of 1984.

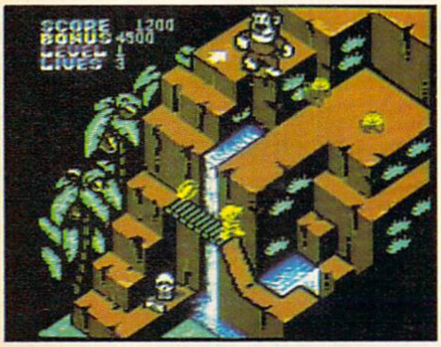


Nominated as Most Innovative Coin-Op Game of 1984 by *Electronic Games* magazine.



#1 Arcade Hit, *Play Meter* Conversions Poll, 8/1/84.

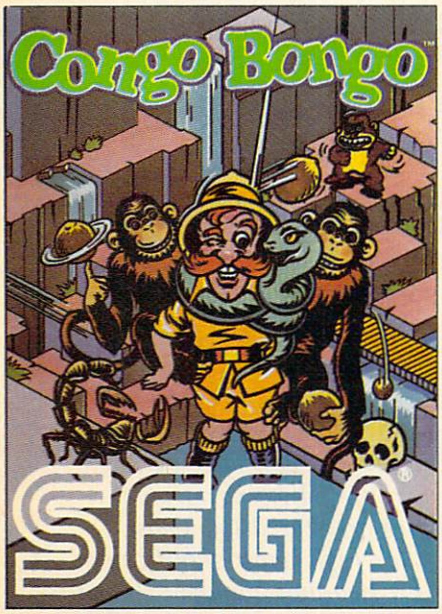
WERE SUCH BIG HITS, THEM HOME.



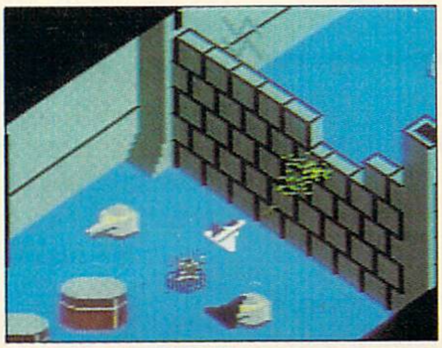
Sega's Congo Bongo rocked the home game world when it shot up to Number 3 on the Billboard chart this spring.

And now it's available for even more home systems. So check the chart and get ready for jungle action. You'll pursue the mighty ape Congo up Monkey Mountain and across the Mighty River. Do battle with dangerous jungle creatures. Ride hippos, dodge charging rhinos and try to avoid becoming a snack for a man-eating fish.

Congo Bongo. It's fast and it's fun. But be careful. It's a jungle in there.



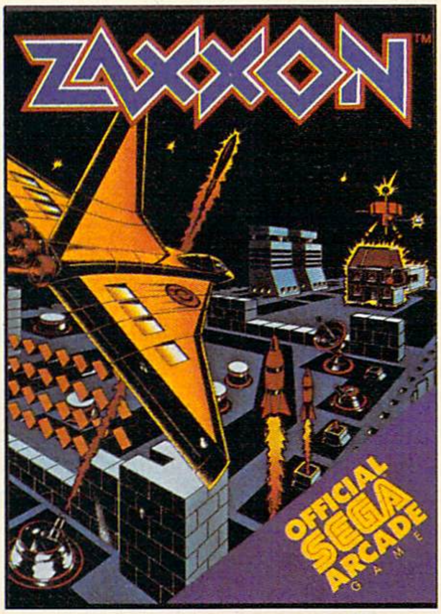
Arcade and Home Smash. Hit #3 on *Billboard* magazine's Top Video Games survey.



Sega's Zaxxon. If you haven't played Zaxxon, you must have been living on another planet for the past few years.

And now the ultimate space combat game is available for even more home systems. You'll pilot a space fighter through force fields and enemy fire on your way to do battle with the mighty Zaxxon robot. Countless others have gone before you in this Hall of Fame game. But this time your life is in your own hands.

Zaxxon killed them in the arcades. But compared to what it will do to you at home, that was child's play.



One of only ten games ever to make *Electronic Games'* Hall of Fame.

	SPY HUNTER	TAPPER	UP 'N DOWN	CONGO BONGO	ZAXXON
Atari 2600 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓
Atari 5200 cartridge				✓	✓ NEW
Atari Computers* cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Atari Computers† diskette	✓ NEW	✓ NEW	✓ NEW		✓
ColecoVision & ADAM cartridge	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Commodore 64 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Commodore 64 diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Apple II, IIe, IIc diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
IBM PC diskette	✓ NEW	✓ ** NEW	✓ NEW	✓ ** NEW	✓ ** NEW

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*Atari 400, 800, 600XL, 800XL and 1200XL.
(Congo Bongo cartridge: 400, 800 and 800XL.)
†Atari 800, 600XL, 800XL and 1200XL.
**Also available for IBM PCjr.

All new games are scheduled to be in your stores for Christmas. Check your local dealer.

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```
230 X(I)=INT(32*((X(I)-1)/32-INT((X
    (I)-1)/32)))+1
240 Y(I)=INT(24*((Y(I)-1)/24-INT((Y
    (I)-1)/24)))+1
250 CALL HCHAR(Y(I),X(I),46+I)
260 NEXT I
270 GOTO 140
```

In this program, each joystick is checked for movement (line 150) and firing (line 160) within a FOR-NEXT loop. If a fire button is being pressed (K equals 18), the program executes a routine to change the color of the appropriate figure (lines 180–190). The old figures are then erased (line 200), new positions calculated (lines 230–240), and new figures drawn (line 250).

80-Column VIC?

I own a VIC-20 which I use with a TV set. I have seen ads for monitors with 40 or 80 columns. If I were to buy one of these monitors, would my VIC-20 display 40 or 80 columns? If so, would it change the screen memory?

Allen Murphy

Unfortunately, changing the display format of your computer isn't that simple. A video monitor or TV displays exactly what the computer tells it to display. The VIC generates a video signal for a picture consisting of 23 rows of characters with 22 characters per row, and 22 characters is what you see no matter whether you send that signal to a TV, a monochrome monitor, or a color monitor. The 40- or 80-column figure you mention is only the manufacturer's rating of the number of characters per row that the monitor is capable of displaying clearly—a measure of the resolution *of the monitor.*

A monitor that gives a good 80-column display should give an exceptionally crisp 22-column display when connected to a VIC. To actually get an 80-column display, you'd have to use one of the 80-column video adapter boards available for the VIC. The adapter would indeed change screen memory, and you'd probably be disappointed to learn that little of your favorite software would work with the 80-column adapter.

80-Column Atari?

I have an Atari 1200XL, a Rana 1000 disk drive, and am using a TV set as a monitor. Would I need to expand the text field to 80 columns to accommodate a letter-quality printer?

Shawn Johnson

This isn't necessary. An 80-column video adapter board is nice to have when you're using a word processor to prepare a document because the screen can show how the document will appear on paper. It's not required, however, because the word processor allows you to specify any width for printing—including 80 or even 132 columns (if your software and printer can handle this). The size and format of the video display does not limit your choice of a printer.

You should also be aware that most TV sets cannot adequately display 80 characters per line; the characters will usually be much too fuzzy to read. You would need to buy a monochrome computer monitor. In addition, we haven't heard of any 80-column adapters for the 1200XL, and it's not likely that any will be sold. Unlike other Atari computers, including the 600XL and 800XL, the 1200XL has no expansion slot.

BASIC To Machine Language

I have a VIC and am currently learning machine language. How can I pass BASIC variables to an ML subroutine?

David P. Ballin

One of the easiest ways to transfer numbers between BASIC and machine language is to store them in memory. Safe memory locations can be used like post office boxes—BASIC can POKE the mail into the boxes, and machine language can pick it up, or vice versa. Here's an example:

In BASIC:

```
300 A=57
310 POKE 251,A
320 SYS 4096
```

In machine language:

```
$1000 CLC
$1001 LDA $FB ;get the value POKEd into 251
```

Of course, this assumes that location 251 is unused for anything else. Now, here's the reverse (transferring data back to BASIC):

In machine language:

```
$1C49 STA $FB ;store the accumulator value into loca-
               tion 251 ($FB)
$1C4B RTS
```

In BASIC:

```
500 A=PEEK(251)
```

With a single POKE you can transfer values in the range of 0 to 255 back and forth. If you want to transfer values larger than 255, use the following formula (where N is the number to be stored):

```
NN=INT(N/256):POKE byte1,N-(NN*256):POKE
byte2,NN
```

This method breaks the value of N into two bytes. The value in memory location byte 1 is the remainder after the integer division of N by 256. The quotient is placed in the following memory location, byte2. The bytes are stored low (least significant) byte first, then high (most significant) byte, a 6502 standard for two-byte numbers. Some good areas for temporary data storage on the VIC

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Twist tabs on the back of the center panel allow for neat concealed grouping of wires while a convenient storage shelf for books or other items lies below.

The printer sits behind a fold down door that provides a work surface for papers or books while using the keyboard. The lift up top allows easy access to the top and rear of the printer. A slot in the printer shelf allows for center as well as rear feed printers.

Behind the lower door are a top shelf for paper, feeding the printer, and a bottom shelf to receive printer copy as well as additional storage.

Stand fits same computers as the CS-1632 as well as the Apple I and II, IBM-PC, Franklin and many others.

The cabinet dimensions overall: 39-1/2" high x 49" wide x 27" deep.

Keyboard shelf 20" deep x 26" wide. Disk drive shelf 15-34" deep x 26" wide. Top shelf for monitor 17" deep x 27" wide. Printer shelf 22" deep x 19" wide.

are locations 679–767, 828–1019 (the cassette buffer), and 251–254 (free zero page locations). The same locations are available on the Commodore 64, plus 4K of free RAM at 49152–53247.

You can also load the accumulator, X, and Y registers from BASIC on a VIC or 64 with the POKE statement. The accumulator is stored in 780 ($30C), the X register in 781 ($30D), the Y register in 782 ($30E), and the status register, P, in 783 ($30F).

Before a SYS statement in BASIC passes control to the SYS address, each register is loaded with the value found in the corresponding storage address. After the ML program finishes execution and returns to BASIC with the RTS instruction, the new value of each register is stored in the appropriate location. This is true only of SYS, not the USR function.

A useful application of this would be formatting the screen by using Kernal routines from BASIC. For instance:

```
POKE781,10:POKE782,5:POKE783,0:SYS65520:PRINT
"HELLO"
```

This prints "HELLO" at row 10, column 5. This line will work on both the VIC and 64, as the PLOT routine is entered via the Kernal jump table.

Another, more tricky way to pass a single value back and forth between BASIC and ML is with the USR function. Like any function, it looks for a value in parentheses. This value is passed to the machine language program. And like any function, it returns a value. A=USR(B) would pass the value of B to the machine language program, which can then pass back a value to be stored into A.

For more information, see Mapping the VIC, Mapping the Commodore 64, *or any of the machine language books from COMPUTE! Books.*

TI CALL Destroy?

I own a TI-99/4A computer and have been using the CALL statement to do various tasks. I have heard that certain commands can burn out chips. Is this true? What can I do to avoid damaging my computer?

Robert Brower

We've heard many stories about how various programs or copyright protection schemes are able to destroy monitors, disk drives, and computers by some devious means. It's true that on some late-model Commodore PETs, a certain POKE would sometimes cause an interface chip to race out of control and out of sync, burning itself out. But this small possibility was highly exaggerated. Likewise, it was once said that cranking up the volume too high in Atari BASIC SOUND statements would burn out the sound chip, but our tests failed to validate this rumor.

As a general rule, no program or command can permanently alter or damage your computer. The worst that can happen is a lockup or system crash: The computer refuses to acknowledge any command from the keyboard. To regain control, you must turn off the computer, then turn it back on again. Of course, any program stored in memory is gone. So if there's a chance the program you're typing in or working on could lock up the computer, be sure to save it before running it.

Atari BASIC AUTORUN

How can I automatically run a BASIC program?

David Lanese

The Atari Disk Operating System (DOS 2.0 and 3.0) has a feature that lets you automatically load and run a machine language program from disk whenever the computer is turned on. This feature can be adapted to run a program written in BASIC.

Here's a short BASIC loader for a machine language program which tells the system on powerup to run a BASIC program named AUTORUN.BAS from disk:

```
CE 10  OPEN #4,8,0,"D1:AUTORUN.SYS"
BA 20  FOR I=1 TO 94
MA 30  READ A
CB 40  PUT #4,A
ON 50  NEXT I
DD 60  CLOSE #4
DO 70  END
AB 80  DATA 255,255,0,6,81,6,216,24
       ,173,48,2,105,4,133,204,173,
       49,2,105,0,133,205,24,160,0,
       177,204,105,162,133,212
OO 90  DATA 160,1,177,204,105,0,133
       ,213,160,32,185,49,6,145,212
       ,136,208,248,169,13,141,74,3
       ,96,0,48,47,43,37,0,24
NI 100  DATA 20,18,12,17,18,26,50,5
        3,46,0,2,36,17,26,33,53,52,
        47,50,53,46,14,34,33,51,2,2
        26,2,227,2,0,6
```

This program, written by Michael E. Hepner, originally appeared in the January 1984 issue of COMPUTE!. *It creates a machine language program on your disk with the filename AUTORUN.SYS. When the computer is turned on, the operating system loads DOS from disk, then runs AUTORUN.SYS if it finds such a program on the disk.*

To automatically load and run your BASIC program, store it on the same disk with the filename AUTORUN.BAS. Of course, only one program per disk can be automatically run using this method.

Another approach using the program above would be to enter the Atari version of "Super Directory" (COMPUTE!, *April 1984) and save it as AUTORUN.BAS on each disk. Then every time you turn on your computer, the boot process ends with Super Directory running and a directory of that disk*

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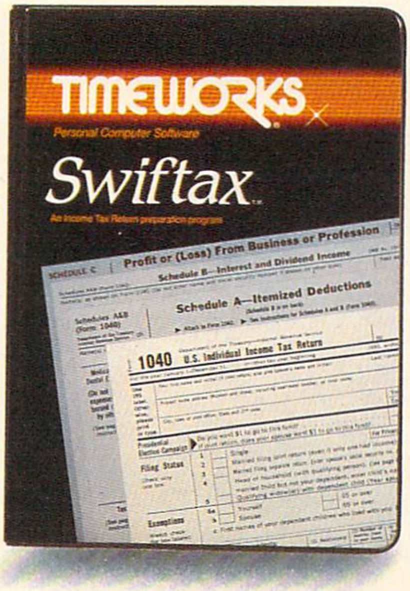
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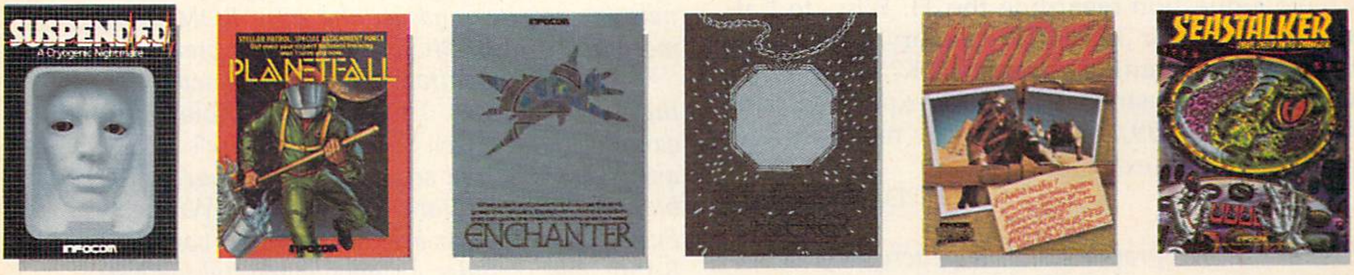

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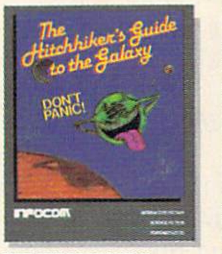

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*Use the IBM PC version for your Compaq, and the MS-DOS 2.0 version for your Wang or Mindset.

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displayed on your screen. Or you could have the program AUTORUN.BAS chain to any other program you desire.

TI Memory Expansion

I have a question regarding the TI: Why do I always see ads for 32K RAM memory expansion, but never anything more than 32K? Is there any way I could construct a memory expansion with 48K for my TI-99/4A, or does the microprocessor just ignore any extra memory?

David Edwards

Like most microprocessors of its generation, the TI-9900 microprocessor in the TI-99/4 and 99/4A can only address directly a maximum of 64K (65536) memory locations. These locations can't all be used for RAM, since the microprocessor must also have some permanent memory (ROM) to hold its operating system. Still more addresses are required to allow the microprocessor to communicate with the various input/output support chips and peripherals. And the ROM for the built-in BASIC language occupies another large chunk of address space. When all these features are added, only 32K of address space remains free for future memory expansion, which is why no expanders larger than 32K are available.

Note that the 16K of RAM built into the TI-99 console is not directly connected to the microprocessor, and doesn't occupy any of its address space. That memory is part of the VDP (Video Display Processor) chip's address space, and the microprocessor can access it only indirectly, via the VDP. TI's built-in BASIC is designed to access only this VDP memory, which is one of the reasons it's comparatively slow. It also explains why standard TI BASIC can't use any expansion memory connected to the microprocessor. (VDP memory can't be expanded beyond the 16K provided.) To make use of the 32K expanded memory, you need TI Extended BASIC *or some other command module.*

Apple & Atari ML Monitor

I use both an Atari 800XL and an Apple IIe. It's very simple to enter the monitor on the Apple: Just enter CALL −151. Is there a simple method like this on the Atari?

James J. Brennan, Jr.

No, because the Atari does not have a built-in machine language monitor. Few personal computers designed since the late 1970s include ML monitors, since manufacturers feel that only a minority of owners are interested in ML programming and monitors take up valuable ROM space. The Apple IIe and IIc retain an ML monitor because they are enhanced versions of the Apple II, originally designed as a kit-built computer for hobbyists in 1976. The Commodore PET, introduced in 1977, also incorporates an ML monitor. But since then, the only computers introduced for the mass market with a built-in monitor have been the Commodore Plus/4 and 16. Most manufacturers today prefer to eliminate the monitor and use the extra ROM space for a more powerful BASIC or operating system.

Excellent monitors are available separately for the Atari, however. The Atari Assembler Editor *cartridge, Optimized Systems Software's* EASMD *and* MAC/65, *and several other commercial assemblers include monitors.* The Monkey Wrench, *by Eastern House Software, adds several commands to BASIC and includes a Commodore-style monitor that you can call from BASIC. However, it works only in the right cartridge slot of an Atari 800, not with the 800XL.*

POKEing Around

I'm a new ML programmer and would like to know what are the numbers you POKE into memory when entering the machine language parts of some BASIC programs?

Kenny Sumrall

Those numbers are the actual object code (the opcodes and operands) of the machine language program. Each machine language instruction has a value (opcode). This value is what the processor sees and executes.

After you write and debug your machine language program, you can use a utility program to turn the object code into a series of DATA statements. The BASIC program POKEs the numbers into memory, and they can then be executed with a SYS, USR, or CALL statement.

VIC Sound

I own a VIC-20 and use a video monitor instead of a TV. However, the monitor is video only, so I can't hear the sounds in my programs. My monitor cable has an audio output plug, but no one—not even Commodore—has been able to give me exact instructions on how to interface for audio. I have been told I need a high-impedance audio amplifier, but have been given no definition of what that means.

Bob Sterzenbach

If you have a home stereo system, you probably have the high-impedance audio amplifier you need. Simply plug the audio output jack on your monitor cable into the auxiliary input jack of your stereo (use an extension cable if necessary). You might also want to use a Y-adapter, which feeds the single input from the computer into both of your stereo inputs. This should provide superb sound quality. As

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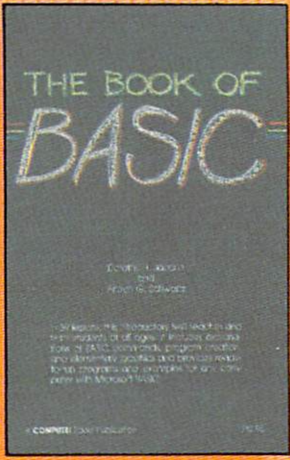
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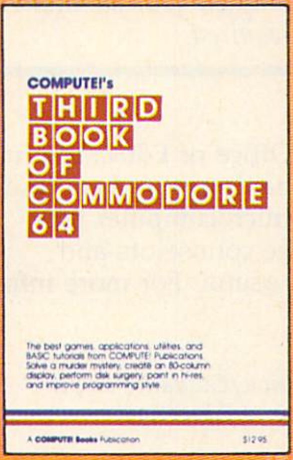
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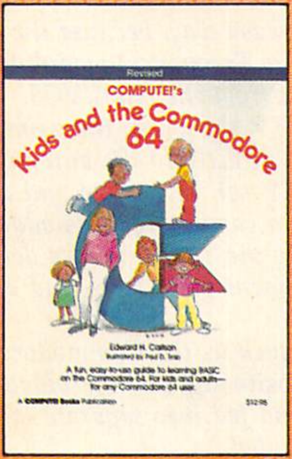
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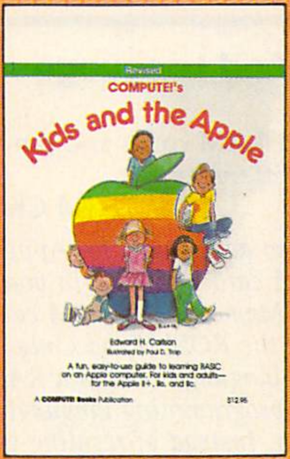
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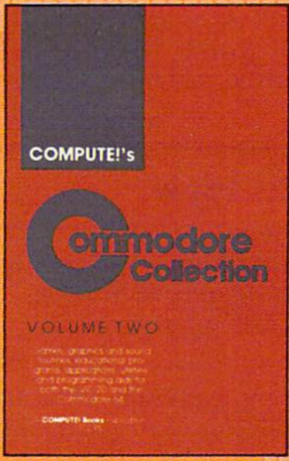
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an alternative, many electronics stores such as Radio Shack sell small battery-powered amplifiers with a built-in speaker. The input jack on the small amplifier may not accept the plug on your monitor cable, so an adapter may be required.

Help For Educators

The Santa Clara County Office of Education has developed a directory of hardware and specifications for over a hundred microcomputer programs that school guidance counselors and administrators might find useful. For more information, contact:

Janey H. Powers
Career/Vocational Education/Guidance Dept.
Santa Clara County Office of Education
100 Skyport Drive
San Jose, CA 95115

Thanks for the information.

Apple RAM Cards And Language Cards

I have frequently heard of RAM cards and language cards. What's the difference?

David Chow

These terms usually apply to accessories for Apple II-series computers. A RAM card is a plug-in board with extra Random Access Memory. The RAM can be used as extra memory if the ROM (Read Only Memory) is mapped out. A language card is a RAM card that is used to load a programming language (such as Pascal) on powerup. Instead of residing in ROM, the language is loaded into the RAM in place of the ROM used by BASIC. Not all RAM cards can act as language cards. Similar accessories are available for computers like the Commodore 64 and Atari.

Commodore 64 Randomness

Sometimes using BASIC's random number generator just isn't convenient, especially in machine language. Most ML programmers find other sources for random numbers. Here's a method for generating random numbers in machine language by using voice 3 of the SID Chip. Set the high-byte of the voice 3 frequency control ($D40F, 54287) to 255, and turn on bit 7 of the control register. (This selects the noise waveform.) Now you can read the upper eight bits of the waveform output from oscillator 3 at $D41B (54299) for random numbers between 1 and 255. Here's an example:

```
LDA #$FF      ;load accumulator with 255
STA $D40F     ;store accumulator in high byte of voice 3
LDA $80       ;load accumulator with 128 (binary
                10000000)
STA $D412     ;set bit 7 of voice 3 control register
LDA $D41B     ;load accumulator with oscillator output
```

David Jones

Thanks for the example. To use the voice 3 noise waveform from BASIC, enter:

```
10 POKE 54287,255
20 POKE 54290,128
30 PRINT PEEK(54299)
```

PEEKing 54299 will reveal a number between 1 and 255. You can continue to read this location without setting up the voice again, but you cannot use voice 3 for sound and for random numbers simultaneously—unless you want a high-pitched rushing sound.

Atari VCS To Monitor

How could I connect an Atari VCS videogame machine to a Commodore 1702 monitor?

Mark Pittenger

Unfortunately, there is no easy way, because the Atari VCS has an RF (Radio Frequency) modulated output. That is, the output from the Atari VCS simulates a signal from a TV station so the game machine can be connected directly to the antenna terminals of an ordinary TV set. The video and audio signals are mixed and a carrier signal is added. The RF demodulator inside the TV set breaks down this output into the component parts for sound and video.

A computer monitor such as the Commodore 1701/1702 needs a composite signal*—the video and audio are separated and fed into separate jacks, and no RF element is included.*

Any standard monitor can be used with a device that has a composite output, such as a computer or videocassette recorder. COMPUTE! *uses Commodore, Amdek, and Zenith monitors interchangeably with Commodore, TI, Apple, and Atari computers. We also know of several people who obtain outstanding pictures using computer monitors with VCRs.*

Saving Programs On Tape

If I type in a program from a magazine or book, can I save it on a tape? Are there any restrictions on doing this? Do some programs look for a disk? If so, how can I tell the difference?

David King

You can save any program you type into your computer on tape simply by following the cassette SAVE instructions for your particular brand of computer. However, for various reasons, some programs will run properly only when used with a disk drive. Most programs published in COMPUTE! *offer you a choice of tape or disk storage; whenever one or the other is mandatory, that will be clearly stated in the* *accompanying article.*

As you become more familiar with the BASIC of your computer, you'll learn to recognize the commands for disk and tape access. In Commodore programs, look for a device number, the number following a LOAD or SAVE command, or the second number in an OPEN command. The number will be 8 for disk and 1 for tape. On the Atari, the characters D: or D2: before a filename specify disk, and C: is used for tape. IBM BASIC usually defaults to disk for OPEN statements. Almost all programs that use data storage on the Apple require a disk drive. Look for the characters DSK or CS for disk or cassette access on the TI-99/4A.

Commodore Repairs

My Commodore 64 broke down recently, and a service technician said I could send it to Commodore and have it repaired for a fee, even if the warranty had expired. Where should I send it?

Paul Cheng

You can return your 64 (and other Commodore equipment) to Commodore Customer Service at the address below. Commodore will either repair or replace the equipment. Here's a list of standard charges for equipment repair:

VIC-20	**$35**
Commodore 64	**$55**
1541 disk drive	**$85**
1525/1526/801 printer	**$75**
1701/1702 color monitor	**$95**

Send a check or money order and a letter describing the problem you're experiencing to:

Commodore Customer Service
1200 Wilson Drive
West Chester, PA 19380

Commodore recommends that you ship your equipment via UPS, packed carefully in the original box if possible. You may also want to insure it.

Self-Programming Computers

I have a Commodore 64, and recently while running a program I encountered a ?SYNTAX ERROR IN LINE 580 message. When I listed line 580, there was none. When I ran the program again, I got another ?SYNTAX ERROR, but this time in line 13337. When I checked the original listing, there was no line numbered 13337. When I listed 13337, all that was displayed was gibberish. Even worse, when I attempted to delete 13337, the screen went black, a strange sound came out of the speaker, and the keyboard locked up. What happened?

Neal Hatton

You didn't mention what kind of program it was, or where you obtained your listing, but you have encountered one of the more subtle programming bugs, the self-modifying program.

It's sometimes necessary to protect your BASIC program from the operating system of your computer and from the program itself. The program may have overwritten itself by storing sprite data or character data in the middle of the BASIC program area, or variables may have been stored over the program due to a corruption of the pointers to the start of the BASIC array storage area, addresses 47 and 48 ($2F–$30).

When sprite data and redefined character data are POKEd into a program, you must exercise some caution to prevent overwriting areas of the program you need. This is one of the things we check when testing programs for publication. If variables are causing the program to overwrite and crash, it could seem to function normally for a while before the program is corrupted.

That gibberish you saw on the screen when you tried to list the program was caused by your computer attempting to interpret the data it found in memory as a BASIC line, reading the data as tokens. Many strange things can happen when a program is destroyed this way, and it's usually necessary to turn off your computer to regain control from your program's nervous breakdown.

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Music in the Computer Age

Richard Mansfield, Senior Editor

Computers are altering every aspect of our lives, but no one likes to be rendered obsolete by a machine—especially artists. Yet, over the past year, a new generation of computerized synthesizers has started to replace some traditional instruments and musicians. You haven't noticed? That's why they're worried.

Is live music dead? Maybe not quite, but it might be dying. You'll probably hear lots of music this week, but it's doubtful that you'll hear any that isn't, in some way, electronically assisted.

If you've ever been in a room while someone was playing a violin, there was nothing between you and the catgut except vibrating air. But such experiences are quite rare these days. If you go to a rock concert, you'll be hearing the music through microphones, amplifiers, and various sound processing devices. Even "live" classical concerts are now miked and amplified.

Also, some apparently live rock music is probably coming from a tape recorder or a sequencer. That means the sounds were played, perfected, and stored weeks ago. The musician onstage presses a playback button and just finger-syncs while his keyboard plays itself.

Breath controllers, drum machines, sequencers, gates, synthesizers, click tracks, samplers, compressors, delays—more and more, music is being made by machines. Some of the sweetest sounds you'll ever hear now come from deep within gray, unfeeling little digital chips.

Are there dangers in the digitization of music? If you're a professional musician, if you've spent your life perfecting your technique on the guitar or violin, the new synthetic music may pose a real threat to your livelihood. The sounds you make can be generated on a keyboard. And a synthesizer can go beyond human abilities: It can play at impossible speeds using impossible fingerings. It never makes mistakes.

Robert Moog, pioneering creator of the Moog Synthesizer, says, "More and more, we see keyboard instruments replacing guitars. We see the creative juice of electronic drum machines, and we see musicians working with computers on stage, synchronizing whole bunches of instruments."

Music is moving, virtually en masse, into the computer age. Some musicians have stopped practicing scales and are now learning how to *program* their instruments, how to extract beauty from this new technology.

In some ways this shift from people to machines is clearly good for music. It's similar to what happened when Gutenberg invented the printing press. Before his great discovery, every book had to be copied by hand, so few people could read, and fewer still could write. Monks took months making just one copy of the Bible. This obviously had a dampening effect on literature and made many ideas accessible only to the privileged few. After all, the essential value of a book is in its words and ideas, not in the physical nature of the book itself.

Likewise, for most of us, the value of music is in its notes, its beauty, not in the way those notes are reproduced. It can take an instrumentalist months of practice to master a Bach fugue. And when we go to a concert and watch the pianist flying through a torturous piece, isn't it possible that we're responding as much to the player's coordination, his or her physical skills, as to the music itself? Live musical performances have something in common with athletic events. In addition to the qualities of the music, the audience is also paying to witness such things as dexterity and endurance.

The new synthetic music is democratizing this important art form. Until now, the requirements of technique, coordination, and years of practice have prevented most of us from actively making music. We could always hear it, but we certainly couldn't play it.

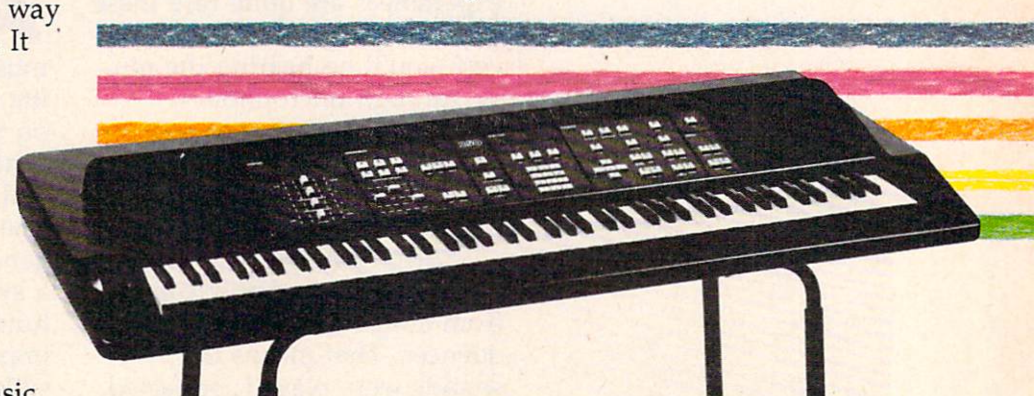
Moog sees some important developments in coming years. "I think more and more now, people are going to be learning to play musical instruments. I'll predict one very specific thing: Within a year or two, there will be electronic pianos that sound every bit as good as professional acoustic pianos, and will play like acoustic pianos, but will be interfaceable with home computers so that you can learn to play the piano with computer-aided instruction programs."

As musical skills become easier to acquire, there is a parallel development in the instruments themselves. Moog and others are now perfecting digital synthesizers that may eventually replace all traditional acoustic instruments, those lovely but costly violins and grand pianos. This kind of synthesizer works by actually recording the acoustic sounds of traditional instruments in digital memory so you can play back the sounds on a keyboard. Sonic accuracy is limited mainly by the quality of the sound system through which these synthesizers are played.

"Technology is such that—and I know this firsthand, this is not a blue-sky prediction—a piano that sounds like a fine grand piano and has a conventional piano keyboard and will be computer-interfaceable, will cost about as much as an inexpensive home spinnet piano," says Moog. "So anyone who can afford to take lessons at home will be interested in this."

Moog is now chief scientist at Kurzweil Music Systems, a company which stunned the music world last year with the introduction of the Kurzweil synthesizer. It looks like a large electric piano, but inside there are no strings, no hammers, probably no wood. Instead, there are rows of computer memory chips holding the digitally recorded sounds of real instruments.

To record these sounds, a musician plays a grand piano, a digital recorder samples the complex sound thousands of



The Kurzweil digital synthesizer: impressive sonic accuracy.

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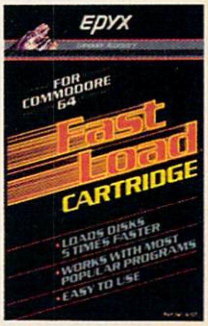
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times a second, a sophisticated pattern-recognition program makes some adjustments, and the resulting series of numbers is burned permanently into Read Only Memory (ROM) chips. Then, when you hit a key on the Kurzweil, the numbers are recalled and it's impossible to tell that you're not listening to a real grand piano. In fact, that's what you *are* listening to: The sound emerges from within a digital chip instead of from a hammer hitting a string, but it *is* the same sound.

A flick of a switch and the Kurzeil becomes a Stratocaster, a timpani, what have you. Any sound can be digitally recorded and played on these synthesizers. For the average person, the only drawback to this amazing device is its current price, $10,795.

The price of computer technology, however, tends to decline quickly. Ensoniq, a Pennsylvania company recently formed by some of the engineers who designed the Commodore 64, has just announced its new Mirage synthesizer. At $1,700, this instrument appears to rival some of the capabilities of the Kurzweil. In some ways, according to engineer Bob Yannes (who designed the SID sound chip inside the Commodore 64), the Mirage exceeds the specifications of the Kurzweil.

The Mirage has a five-octave, velocity (finger pressure) sensitive keyboard. Different tone colors (instruments) can be assigned to different parts of the keyboard. Plus it has all the features of a typical synthesizer: eight-voice polyphony (eight keys can be pressed simultaneously), pitch bend, vibrato, a MIDI (Musical Instrument Digital Interface) jack, an optional foot switch, and more. Any sound can be modified. One hundred different parameters can be manipulated.

ensoniq
Mirage

Ensoniq's new Mirage has digital sampling and synthesis at a consumer-level price.

But the Mirage goes beyond most inexpensive synthesizers by offering digitally stored sounds, an onboard 330-event *sequencer* (which allows you to record and infinitely overdub sounds in digital memory before recording them on tape), an optional sequencer expansion to 990 events, and a *user-sampling* capability (for recording and synthesizing your own acoustic instrument sounds). There is also a built-in 3.5-inch microfloppy disk drive which can store either sounds or sequences of sounds.

Perhaps the most interesting of the Mirage's features is the user-sampling. You can record up to two seconds of high-quality, 15 kHz sound per sample (up to four seconds with less resolution). You can digitally record a violin, a bassoon, your own voice, barking dogs, or anything else and then play it on the Mirage keyboard. A rear input jack accepts sounds either from a microphone or from a high-level source like a tape recorder.

The value of sampling is in the versatility it brings to your instrument. You can control whatever sounds you wish. Marco Alpert, marketing director for E-Mu Systems, another manufacturer of sampling synthesizers, explains that sampling makes any sound into a pitched instrument. From one tone, a sampling synthesizer can extrapolate all the other tones in the scale over several octaves.

For example, if you sample the sound of a wine glass and feed it into the synthesizer, you'll quickly have octaves of perfectly tuned wine glasses. "Wipe your finger around the top of it and suddenly you've got a glass harmonica under your fingers, perfectly in tune, and much easier to play than any original glass harmonica," says Alpert.

The Ensoniq Mirage, and several other sampling synthesizers, can also be interfaced with personal computers for even more flexibility. You can plug the Mirage into an Apple and shape the sounds visually on the monitor screen. This gives you access to each sound's wave table and the ability to modify it directly.

Mirage designer Yannes claims that Ensoniq was able to keep the Mirage's costs down while including all these sophisticated features by designing a new large-scale integrated microchip to handle much of the work. There's also a 16K operating system which loads from disk (to permit easy future modifications to the program). The synthesizer contains 124K

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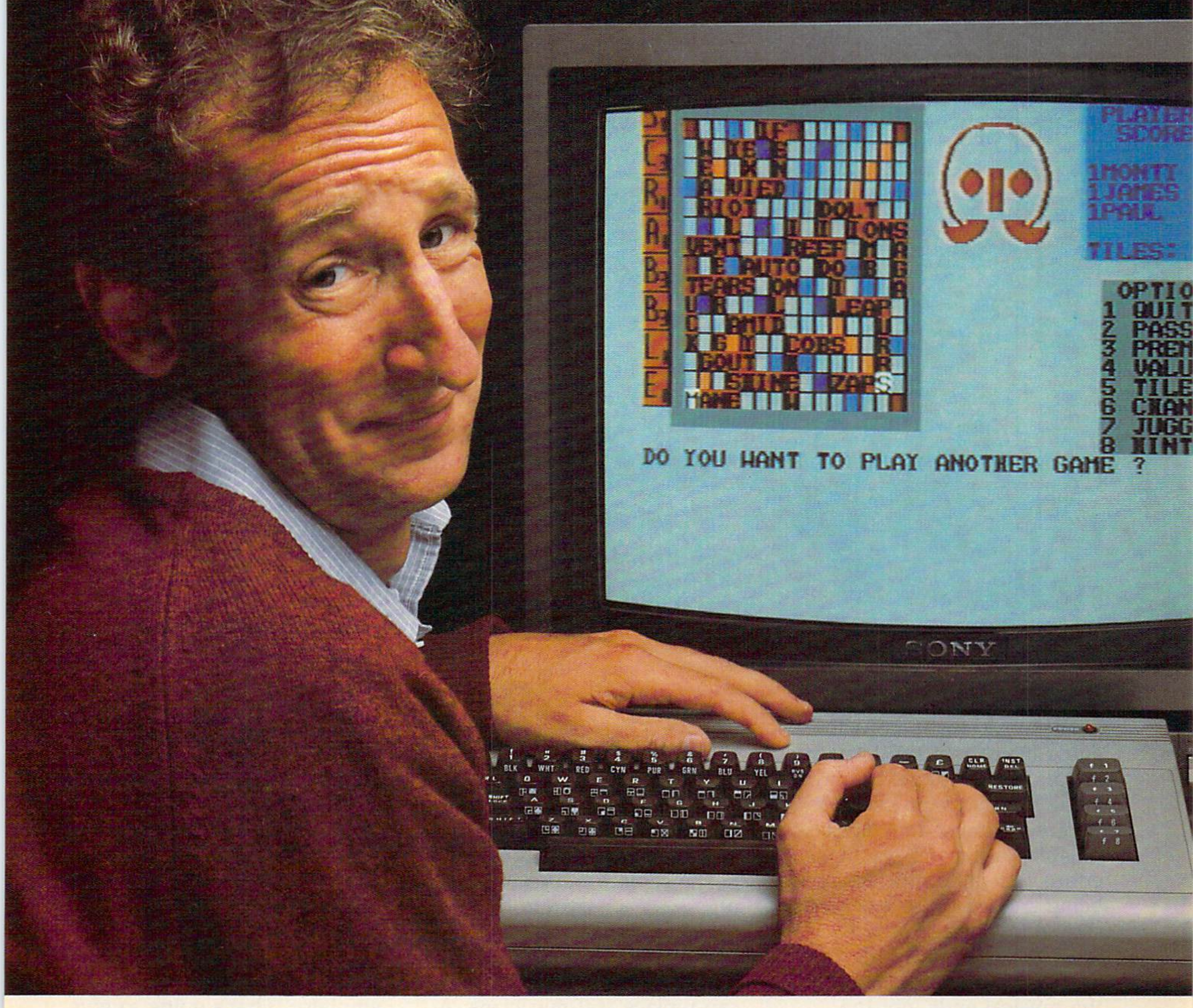
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of sampling storage RAM. Yannes says the Mirage and the Kurzweil both achieve their sounds the same way: The digital sounds repeat themselves if you sustain the note beyond the length of the stored recording. The envelope of each sound is synthesized.

The rock band Utopia: (from left) Todd Rundgren, Kasim Sulton, Roger Powell, Willie Wilcox.

It's clear that this technology is having an impact on musicians everywhere. You hear about musicians' unions threatening boycotts if synthesizers are allowed onstage, drummers being excused from recording sessions because they are less reliable than drum machines, entire orchestral movie scores being created by a single musician on a single machine.

Rocker Todd Rundgren agrees philosophically that it's the musical ends, not the means, that matter. "When someone uses a synthesizer, for instance, to create the sound of an orchestra," Rundgren told COMPUTE!, "we're making some presumption that only because previously it required a large number of people and a lot of catgut and wood instruments and various things like that to create the sound, that that is the only way to create the sound. Sound is sound. From a listener's standpoint, the only thing that's important is the sound. It's not how the sound is created."

On the other hand, while aware of the Luddite rumblings from some musicians, Rundgren senses no fear of synthesizers among his musician friends. "Everybody wants to get their hands on one. Everyone wants to have a Fairlight or something similar—a digital sampling instrument."

Rundgren feels that today's synthesizers are primarily used as tools to assist in composition, not to replace musicians or to offer easy answers to the musical aspirations of the general population. "Nobody who plays a synthesizer claims that they can replace real musicians. A synthesizer puts certain sounds within the grasp of the average musician. Nine times out of ten, it's someone intensely into playing or intensely into composing."

Nevertheless, he foresees a continuing musical revolution based on synthesized sound. "There's no limit to how sophisticated they can get. Things become obsolete every couple of months."

At the center of the controversy, synthesizer manufacturers, too, are wary about predicting that their machines will replace live session musicians. E-Mu Systems' Alpert says it will happen—but only to a degree. "For certain sorts of things, particularly things like string background, I think the day is approaching. It can replace it, but it can replace it, quite honestly, at some reduction in quality. Not so much sound quality, but there is something about a string section full of real players playing the music in realtime that has about it a quality that so far no keyboard instrument can completely emulate."

He feels that synthesized, sampled sounds, while they cannot entirely replace human musicians, do offer an alternative. "It's still not the string section of the London Symphony, even if that's what you've recorded. There's a lot of talk about, well, it's going to put string players out of business. I tend to think it isn't. I tend to think what it does is make high-quality string parts available to people whose choice is not between hiring a string section and buying an emulator; it's between buying an emulator or not having strings at all. If I were a producer and could afford a string section, I'm almost always going to have a string section instead of an emulator. I might work out my parts on an emulator. That's going to give you a pretty fair representation of what it's going to sound like."

Jim Aikin, associate editor of *Keyboard* magazine, finds the new technology both pervasive and powerful. "Synthesizers are having an enormous impact on the music business. They're changing the way people play and think about music. It's not

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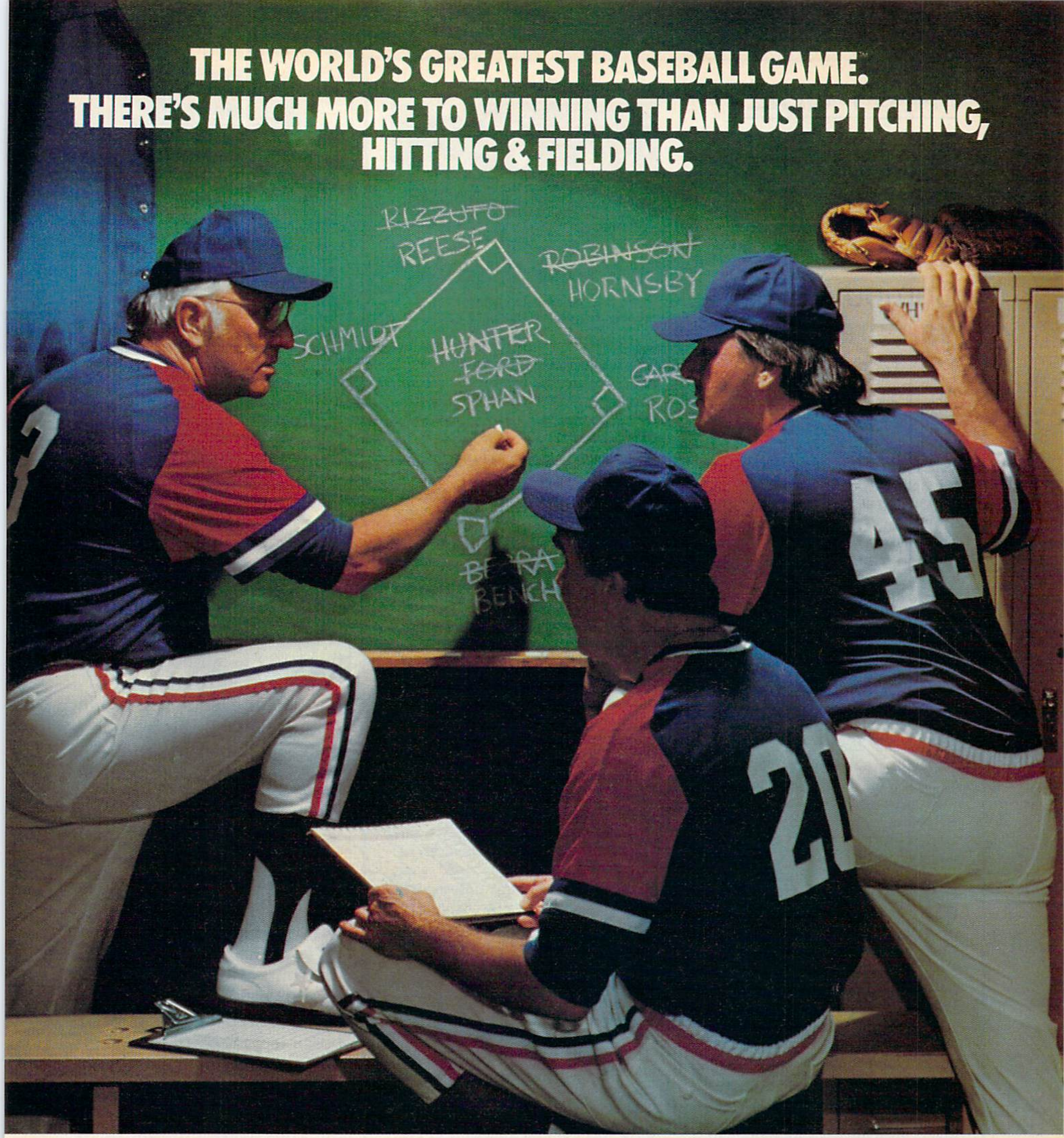
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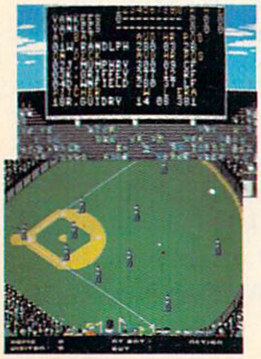

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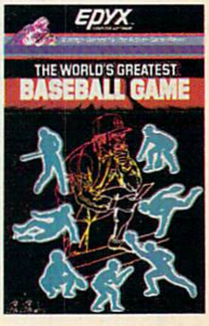
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PARTY QUIZ

Best kept secret of the season

Computer gamers play PQ for hours

by Tom Benford

What's a PQ, you ask? See—I told you it was the best-kept secret! PQ stands for *Party Quiz,* a computer-trivia game from Suncom Inc.

PQ is a *social* trivia game that allows up to four players to participate simultaneously. Each player uses a controller to respond directly to the trivia questions on the screen.

Recently, a couple of friends, Chuck and Joan, stopped over to visit. I had just received my review copy of *PQ* that afternoon, and I decided to "boot-up" the program and see just how social this game really was. I couldn't have picked a better couple to participate in an "acid test"—Chuck hates board-type trivia games, and Joan absolutely loathes computers, although she likes trivia questions.

Setting up the game was easy. Each set comes with 2700 "general" questions. Suncom will be offering additional question disks covering specific categories including Sports, Entertainment, a "Bible Edition", and General Edition 2 which expands your inventory of general questions. I received the Commodore/Atari version, although *Party Quiz* is also available for the Apple and will be available soon for the IBM-PC.

After offering my guests beverages and excusing myself to fetch their drinks, I slipped into my study and loaded the game. Returning, I casually asked, "Which country was the first to issue postage stamps and what was the year?" Joan quickly answered, "Great Britain in 1840; now ask me a hard one!" My plan was working; we were on the subject of trivia. I mentioned that I had just received PQ that day, and I was wondering if they'd like to try answering some of the questions asked by the computer. We gravitated into my study.

I handed controllers to Joan and Chuck. My wife, Liz, and I manned the third and fourth. I explained that the computer would display a question, along with four possible answers which were numbered 1-4. The rules were simple: select the right answer and press the corresponding button on the controller. Joan mumbled something about being a klutz, but she took the controller anyway, eyeing it suspiciously.

After Joan answered the first two questions correctly, I suspected that I was being set-up here; for a "klutz" who hated computers, she was doing very well. She missed on the third question, but Chuck answered correctly. Liz answered the next few questions correctly, and then finally, I got one right. It's not every day I get to look like a dummy in front of my friends!

We spent hours playing Party Quiz and all had a great time playing! The questions covered a myriad of topics, from the color of the Lone Ranger's pants to whether the first footprint on the moon was from a right or left foot.

It had been a special evening, indeed! It's not often that I get the chance to use "non-computing" people for play-testing a new product, and even rarer when I can have my friends actively participate in a computer-based game. We're even considering throwing a PQ Party one of these weekends!

As they were departing for home, Joan mentioned that it was about time she bought a computer for her son to do his schoolwork on. Who's she kidding? Not me—I know she's going to buy one to play Party Quiz on!

As I mentioned at the beginning of this piece, PQ is probably the best-kept secret of this Christmas season, at least for now. If you know someone who has a home computer, and/or is a trivia buff, why not pick up a copy of Party Quiz—it makes a perfect Christmas gift. But you'd better hurry while you can still get one—you know how hard it is to keep things a secret at this time of year!

PQ is available at your favorite local computer retailer. To locate the dealer nearest you, call toll free 1-800-323-8341.
(In Illinois 1-312-459-8000).

Tom Benford is Associate Editor of Run Magazine, *Technical Director of* Electronic Games Magazine *and a frequent contributor to* Video *and* In-Cider *magazines.*

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PQ: First "social" computer entertainment

Emulator II
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E-Mu Systems offered one of the first sampling synthesizers. This is the more recent Emulator II.

just the synthesizers you're talking about here. You're talking about digital technology in general, which takes the form of a computer code that's dumped onto one channel of the multitrack tape during the recording process, and then everything in the studio is synchronized to that code."

These *click tracks* to which Aikin refers can be relentless in their accuracy. They're like a metronome which triggers every musical instrument in the room except the singer.

Even if synthesizers and computers do start replacing some musicians, many experts draw a distinction between the composition process and the instrumental process. While some concede that it might be possible to replace drummers or pianists, few believe that a machine will soon replace composers. It's easy enough to see that the Gutenberg printing press could replace monks copying manuscripts, but it is more difficult to imagine a machine that could *write* a book or a symphony.

"I think we're ten or fifteen years away from that, minimum," says Aikin, "because the algorithms that are involved in compositional approaches are not simple."

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The music press has reported experiments in which melodies were generated randomly via computer, but the order of the notes is deliberately weighted in certain ways so there will be smaller intervals between notes. These and other built-in rules contribute to more aesthetically pleasant melodic lines. Whether or not a computer could achieve sufficient musical sophistication to create tunes that would please humans is open to debate.

But there are exciting prospects in several areas where computerized music can take us beyond what we currently experience at concerts or at the dance.

"We're going to be seeing languages that generate sounds in response to the physical movements of a dancer by directly sensing what the dancer is doing," Aikin says. A synthesizer could create music which reflects the dancer's improvisations. It's this multipurpose nature of computers which Aikin and others see as the greatest contribution of the new technology.

Although the debate continues, most experts do agree that the repercussions of the computerization of music are as yet imperfectly understood, but of enormous import. We haven't heard anything yet. ©

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COMPUTE!'s Author Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. **COMPUTE!** is primarily interested in new and timely articles on VIC, Apple, PET/CBM, Commodore 64, Atari, and TI/99-4A. We are much more concerned with the content of an article than with its style. Above all, articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* Please use high quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I=1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length – from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5x7, black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. **COMPUTE!** pays between $50 and $600 for published articles. In general, the rate reflects the length of the article. Payment is made upon acceptance of an article. Following submission (Editorial Department, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose an SASE.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing "Revision" on the envelope and the article.

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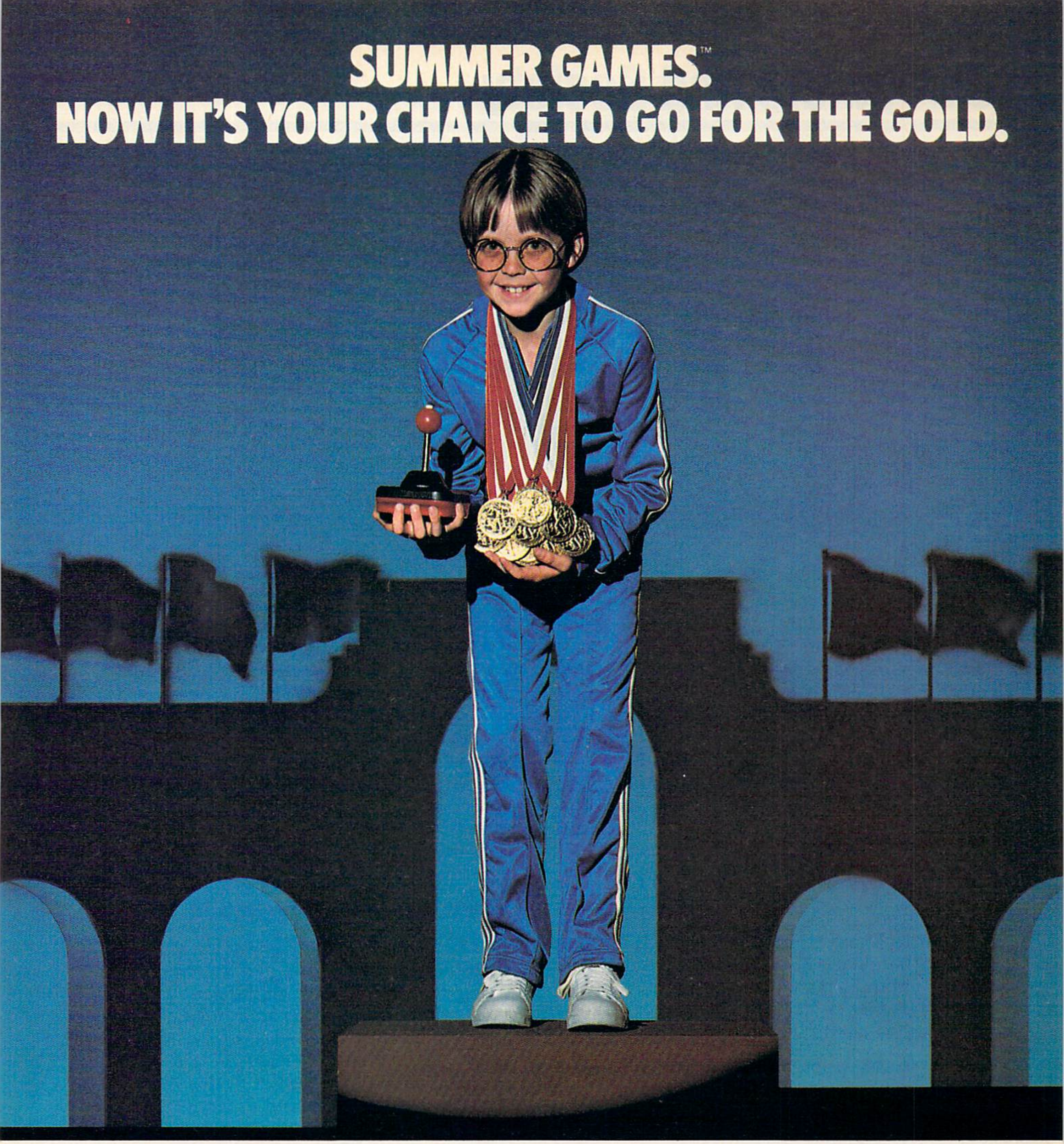

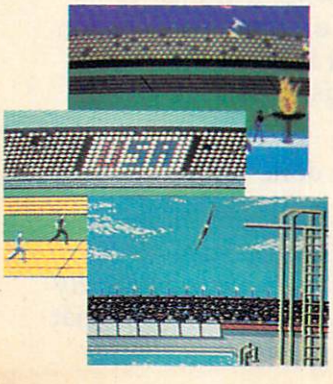

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Computers And Society

David D. Thornburg, Associate Editor

1984 Revisited

The nightmare predicted by George Orwell in his book *1984* never came true.

Of course, there weren't many people who thought it would. Even so, it was hard to go through this past year without comparing our reality to the Orwellian vision of a totalitarian society that used technology to maintain its grip on people's lives. The technological world predicted by Orwell over 35 years ago is pretty tame compared to the technological realities we have available to us today. He predicted two-way television, word processors, and data base systems.

Ho hum.

Our technological reality has been far more exciting than that—laser disks, personal computers, the entire personal electronics revolution. But, just as Orwell underestimated our technical advances, he overestimated the political changes that formed the basis for his novel. We are not pursued by the Thought Police (thank God), nor are we embroiled in endless wars to support the economy. Most importantly, we have not become slaves to our technology.

Rather than living in an era of repression, we are engaged in a renaissance of rediscovery. Rather than being victimized by our technology, we are liberated by it. Rather than bending our lives to fit the functional patterns of our technology, we are reshaping and refining our technology to be responsive to our ways of doing things.

What Really Happened In 1984

Some examples:

- It was in 1984 that the public continued its long-term rejection of chiclet keyboards. IBM, thought by some to be an industrial metaphor for Big Brother, listened to the customers and gave them what they wanted—a normal typewriter-style keyboard. In this regard, IBM joined ranks with TI and Radio Shack to acknowledge that as far as keyboards are concerned, the public knows what it wants. While this response was a result of customer rejection of the first PCjr product, it is important to know that IBM was responsive to customer's demands.

  Big Brother wouldn't have done that.

- It was in 1984 that a new paradigm in personal computing was introduced in the form of the Apple Macintosh. For the first time, a relatively inexpensive computer was sold on the idea that

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David Thornburg is the author of 11 books, including The KoalaPad Book, Computer Art and Animation *(a Logo book available in versions for the TI, Radio Shack, Atari, and Commodore computers), and* Exploring Logo Without a Computer *(published by Addison-Wesley). His whimsical look at computing (*101 Ways to Use a Macintosh*) has been published by Random House. Later this year, his first book on Logo as a tool for exploring topics like artificial intelligence (*Beyond Turtle Graphics*) will be published by Addison-Wesley. Thornburg's editorial opinions have appeared in* COMPUTE! *since its inception.*

people should be able to use this technology in an intuitive, descriptive manner—telling the computer what to do, instead of prescribing how to do it.

My guess is that Apple will have shipped 300,000 of these machines by the time the dust settles from 1984, with another 900,000 to move into people's homes, schools, and businesses in 1985.

- It was in 1984 that PROLOG started to receive more attention as a programming language in the U.S. Software companies sprang into existence to use this language to create programs that function as "expert advisers" to the user. At last the chains of rigidly defined data base structures are being broken, as users can extract information with free-form queries in an English-like language.
- It was in 1984 that people took even greater advantage of computer portability as machines like the Radio Shack Model 100 started showing up in board rooms and at the beach, replacing the ubiquitous yellow legal pad and carrying their owners firmly into the twentieth century.

Gaining Personal Control

In looking at the growth in hardware and software technology in 1984, one trend became increasingly clear as the year progressed. Technology moved in the direction of giving people independent control over their tools. Even the home entertainment software industry showed that we are far from becoming a nation of couch potatoes. Just look at the overwhelming popularity of "construction set" games such as *Loderunner,* in which players get to create their own playfields and game levels.

If there is a message to be gained from Orwell's *1984,* it is this: People can be enslaved with the help of their technology only when they relinquish control of their lives to others. A reason that computers have failed to become the faceless masters of our future is that we have taken personal control of this technology, molding and shaping it to serve both our needs and our whims.

The existence of several million personal computers in people's homes has an importance that goes beyond the technology itself. By becoming familiar with computers, we, as a nation, have become aware of what computers can and cannot do. We are aware of their benefits and potential dangers. As an informed public, we are able to comprehend the implications and ramifications of computers in the government, workplace, school, and home.

Had we known as much about nuclear power 20 years ago, I doubt we would be facing our current dilemma on that topic.

In December 1983, I suggested in this column that it was our increased sensitivities as human beings that were going to keep 1984 from being anything like Orwell's vision for that year. I remain encouraged in this regard. A recent article in a major magazine for computer department managers suggested that we should populate our data processing departments with musicians rather than computer scientists—that diversity and breadth in education is far more important than the acquisition of intensely defined skills in a narrow field.

A Technological Renaissance

It is this sort of thinking that suggests that we are embarking on a renaissance—a period in which technology and the arts are in harmony with each other, rather than being in perpetual conflict. More and more, I am finding technologists who are "people" people first—whose sense of values is directed more toward peaceful cohabitation on this planet than towards the twiddling of bits.

In fact, it is the technology itself that makes this renaissance possible. It is made possible first by taking over the cumbersome repetitive tasks that previously occupied much of our time. By relegating such tasks to the computer, we are freed to exercise those creative tasks that are uniquely human.

Second, computer technology has allowed the creation of a new aesthetic—a new breed of art and artisans who paint through numbers rather than with them.

For example, I am presently exploring the features of a new version of Logo that lets me create and manipulate three-dimensional objects on the display screen of my Macintosh. (This is *ExperLogo* from Expertelligence in Santa Barbara, California.) I can, with simple procedures, create a model of a three-dimensional object that I can modify, manipulate, rotate, and view on the screen from any angle I choose. I can use programs I have written in this language to explore the properties of objects that are only fantasies of my mind—that are not yet constructed, and that may never be constructed.

This freedom to explore mental constructs with ease was unknown during the first Renaissance. It will be commonplace in this one.

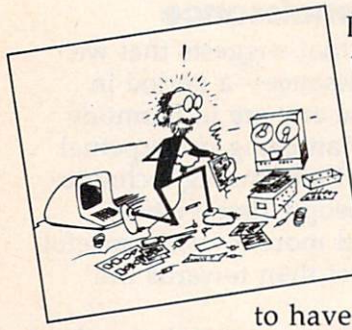
And so, as we enter 1985, let us all acknowledge that it is we who shape and control our technological destiny, and that it is we who will determine whether our lives will be controlled or enhanced by our inventions.

I vote for enhancement—Happy New Year! ©

THE WORLD INSIDE THE COMPUTER

Our Computer Handyman

Fred D'Ignazio, Associate Editor



Late last spring I was talking with David James, the computer instructor at Patrick Henry High School here in Roanoke, Virginia. I told David I was using and reviewing all sorts of computers, and I would love to have an assistant who could help me with the technical aspects. I complained about my .06 percent mechanical aptitude (see my October and November columns, "How Computers Made Me Smarter After Only Thirteen Years of Daily Use"). David smiled. "I have just the student for you!" he exclaimed.

Two days later Howard Boggess showed up. Howard was a senior at Patrick Henry on his way to Tulane University in New Orleans. He had worked at a local computer store and was a dedicated hacker. Most nights (school nights) he would sit up fiddling with his Apple IIe with its twin monitor screens until 2:00 or 3:00 a.m.

Before Howard came we had lots of computer equipment around the house. But lots of it was unplugged, disconnected, or banished to the computer "graveyard" in the attic.

The computer graveyard was an eerie place. A magazine photographer working on a story once made me take him up to the graveyard. He took pictures of me kneeling on the floor, surrounded and dwarfed by old card cages, S-100 motherboards, upended video monitors, twining, snakelike cables, stacks of out-of-date circuit cards, and dead computers. When his photograph appeared in the magazine I noticed that two joysticks were sitting on a box behind me and stuck up above my head like high-tech devil's horns.

When I first led Howard up into the attic, he was impressed. "Wow!" he said. "What is all this stuff?"

I explained, and he asked me why I stored it away in the attic. "Because I can't make it work," I confessed. "So I bring it up here. I don't have time to fix all this stuff. I'm a writer, not a computer mechanic."

Howard was appalled. All his computer equipment was scavenged, secondhand, and patched together. To him my graveyard looked like the delicious leftovers from a sumptuous royal banquet. "Maybe we can use some of this equipment," he said.

"All right," I said. "Do with it what you will." I turned around and fled back downstairs, glad to return to a world where at least some of the machines were still alive.

A Houseful Of Computers

Howard worked up in the attic for about a month, unearthing and resurrecting the machines. Then he brought his motley crew back downstairs. The machines made a miraculous recovery and beeped and whirred and processed information like any of my other healthy computers.

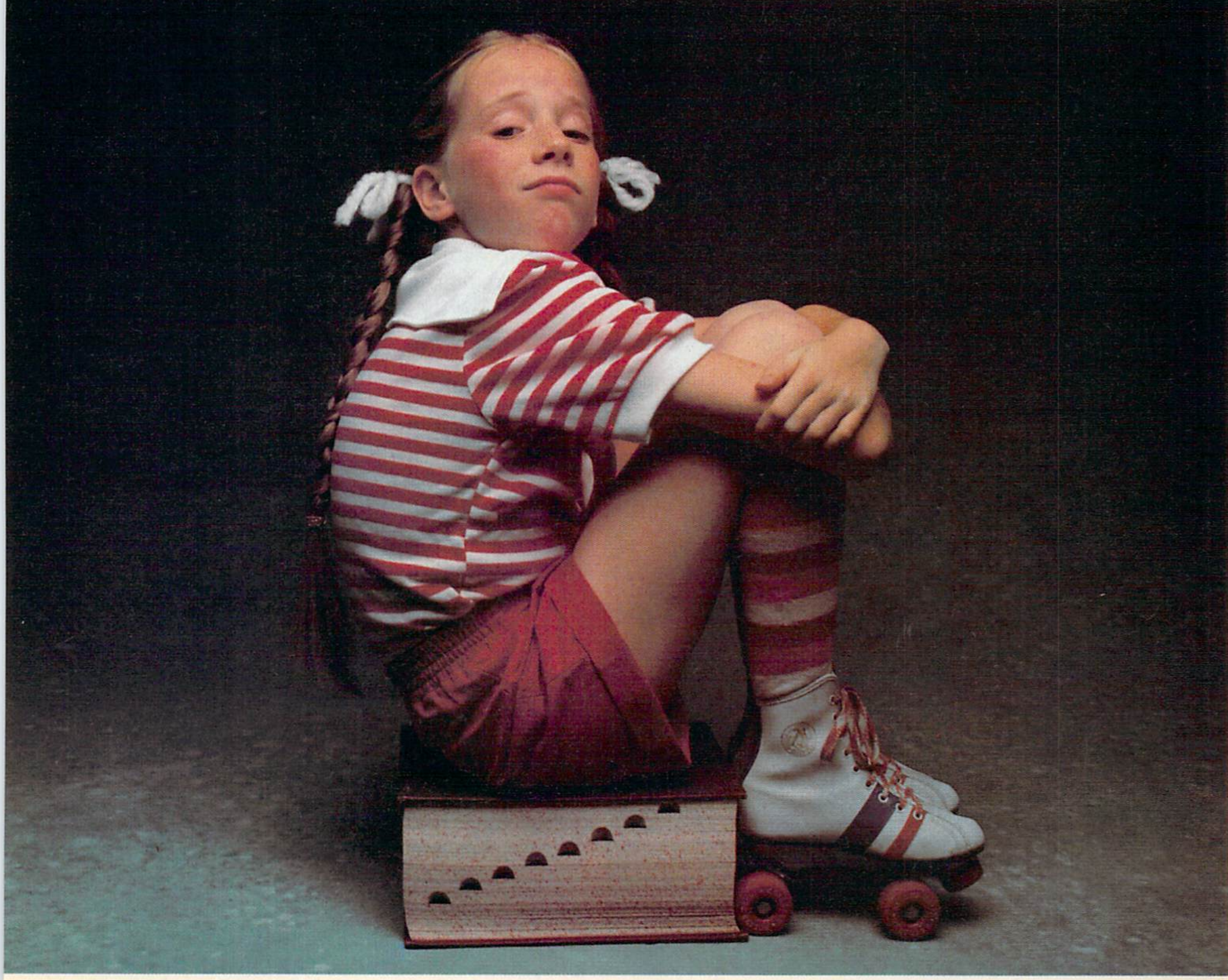
Howard had worked a major miracle, but he didn't stop there. Once he returned downstairs, he began fixing and plugging in all the computers that lay idle or ignored. And, I'm embarrassed to admit, there were quite a number of machines that fell into this category.

My five-year-old son Eric was impressed

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer *(Creative Computing),* Chip Mitchell: The Case of the Stolen Computer Brains *(Dutton/Lodestar),*The Star Wars Question and Answer Book About Computers *(Random House), and* How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) *(McGraw-Hill).*

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in COMPUTE!.

IN A CLASS BY HERSELF.



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with all the new computers we seemed to have around the house. He didn't know we had so many computers because most of the time they didn't work.

Eric came home from kindergarten one day and walked around the house, watching all the machines happily spitting out paper, playing music, and flashing words and pictures. When he arrived in my study, I could see that he was in awe. When he asked me who had fixed them all, I named Howard. "How did Howard do it?" he asked.

Just then my eight-year-old daughter Catie stuck her head in the door and answered, "Because Howard is naturally intelligent.

"Unlike Daddy," she continued, "who is naturally dumb."

The Computer Party Line

One day while I was tapping away at my computer keyboard in my upstairs study, Howard came in and asked me why none of the computers was connected to a modem. I knew that Howard was a bulletin board fanatic. He spent most of the time using his Apple to roam around the country's bulletin boards, trading software and acting as dozens of people's on-line handyman.

"It seems a shame to have all these computers," he said, "and none of them can talk to each other."

I think I must have scratched my head at that point. Or else maybe I nodded. In any case, Howard took that as a green light to get our computers on-line with each other and communicating. Within a month he had every computer in the house talking with every other computer. We had joined four information networks, and the phone company was making house calls every other day.

By the end of the month our lives settled into a semblance of order. But during the month utter chaos reigned. For example, my wife would come home from work at night, and the phone would ring. She would run into the kitchen to answer it, but no one would be at the other end. This was because the kitchen phone was not ringing. Instead it was another phone on a different line that had just been installed that day. And it was still ringing.

RING
RING
HELLO?
HELLO?
HELLO?
HELLO?

Janet would hang up the kitchen phone and dash into our dining room and pick up the phone in there. Again nobody would answer. It was another phone that was ringing. It was the upstairs phone that had been installed in my son's bedroom the day before.

This daily mad dash for the telephone did nothing to improve my wife's mood after a hard day at the office. And it wasn't the only thing she faced when she returned to the house.

Musical Telephones

I tried to dedicate some of the telephone lines to the computers, some to my professional work, and some to the family. Except I kept changing my mind. So every couple of days, I called the phone company, and they came back and switched the phone lines. By the time Janet came home from work each night, all the phones had different numbers than when she left the house that morning.

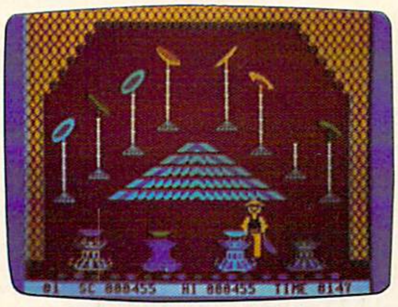
Playing musical telephones was bad enough, but things got even worse. The computers began spending more and more time on the phones, and as they got on-line, they bumped family members off-line. For a brief period, almost every time somebody would pick up a telephone they would find that a computer was already there, chatting to another computer.

Also, during the same period, we went through a couple of days in which we were shut off from the world. No one who called us could reach us because every time the phone rang, a computer would answer. Whenever a phone rang, somebody would race wildly through the house picking up receivers and crying "Hello! Hello!" But a computer would always be there first, whining its irritating high-frequency carrier tone at whoever had the misfortune to call us.

As I remember, handyman Howard was not available during this period. He must have been taking tests at school or something. So without his help, we just gave up. One day my wife arrived home from work, and the phone rang.

Quick.

How many plates can the Juggler juggle?



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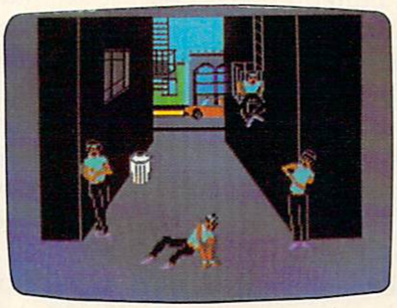

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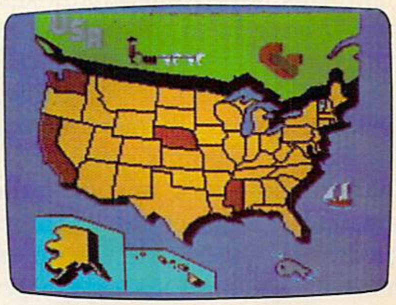

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"Aren't you going to get it?" she asked. "Nope," I said. "The computer will answer it."

It did. Then it promptly hung up.

It was a very efficient way to handle calls.

Our Family's Electronic Mailboxes

After about a month, as I said, our lives gradually returned to normal. We kicked the computers off the phones at certain hours of the day, and we forbade them from answering the phones, unless we were sure another computer was making the call.

This was when we discovered electronic mailboxes. Electronic mailboxes and bulletin boards have been the biggest new thing in our family's life since Eric was potty-trained.

With Howard as our guide, we began setting up electronic mailboxes and posting bulletins on The Source, CompuServe, MCI Mail, the Plato Learning Network, and on bulletin board systems around the country. Then we filled the mailboxes and boards with messages. Going online was a marvelous experience—like launching helium balloons with our names and messages tied to them. We were reaching out to utter strangers, and we didn't know who would respond or where they might respond from.

And the strangers responded. We heard from a teenager in Wisconsin, an engineer in Texas, a retired teacher in Kentucky, and from many other people. And we wrote back.

To encourage more people to correspond with me electronically, I began listing all my mailbox user-identification codes on the river of paper mail that flows out of my office every day. And whenever I called anyone on the phone I made a point of saying, "You know, this voice stuff is really old hat. We should be talking computer-to-computer, not person-to-person. That's the way to really stay in touch."

When I did this, even more people responded. I got software publishers on the networks, teachers, parents, and distant members of my family. But I still wasn't satisfied. In fact, none of us were. Then I realized: We were all hooked. We had developed an appetite for electronic mail the same way we had an appetite for paper mail. The big difference was that with paper mail, you know you can count on only one delivery a day, six days a week. But with electronic mail, there's always the hope that the electronic "mailperson" has delivered a letter for you and it's waiting on some computer system right now. All you have to do is turn on your computer and check all your mailboxes. One of them may contain a letter.

Intra-Home Electronic Mail

This hunger for electronic mail became insatiable, and it affected all of us, except for Mowie the cat. When we woke up in the morning, even before we made trips to the bathroom, all of us would dash to a computer and begin checking our mailboxes. After breakfast we would check our mailboxes again. As soon as my kids came home from school, they checked their mailboxes. When Janet got home from work, she checked her mailbox. And we all checked our mailboxes again at dinner, and before we went to bed.

We have a lot of friends, but we don't have enough friends who can spend all day writing us letters to keep our electronic mailboxes full. So we found that most of the time our mailboxes were empty, and this made us unhappy.

Then Howard showed up, listened to our problem, and came up with a great idea. "Why not," he said, "send letters to each other?"

At first this seemed like a crazy idea. Why should we send letters to each other? We lived with each other, saw each other, and talked with each other all the time. Why should we send mail to each other?

"Just try it," said Howard, "and I'll bet you like it."

He was right! We began leaving each other little notes on the computer, and pretty soon we were sending long letters. It was as if we had opened the floodgates. Apparently, we had a lot more to say to each other than we had been able to say face-to-face.

And no wonder! All the members of my family are so busy and going in so many directions at once that we rarely have the chance to sit down and casually ask questions like, "How was your day?" or "How is your life?" or "Is anything bothering you?" The moment rarely arises when two people in our family are in a mood or have enough time to have a conversation.

But now, using our electronic mailboxes, we ask these questions electronically and have electronic conversations—long, serious conversations unlike any we've ever had before. The mailboxes bring the different members of my family together by letting them talk when they have time or want to talk, and listen when they have time or are in the mood to listen.

In the past, it was rare that a family talker could find a listener when they had something to say. So they just didn't say it. And either it stayed bottled up inside and festered, or they simply forgot it. Now, when family members have something to say, they sit down at the computer and type it as a letter and send copies to each family member they want to say it to. And when those family members feel in the mood to get mail or have time to listen, they sit down at the computer and read their mail. And then they write back.

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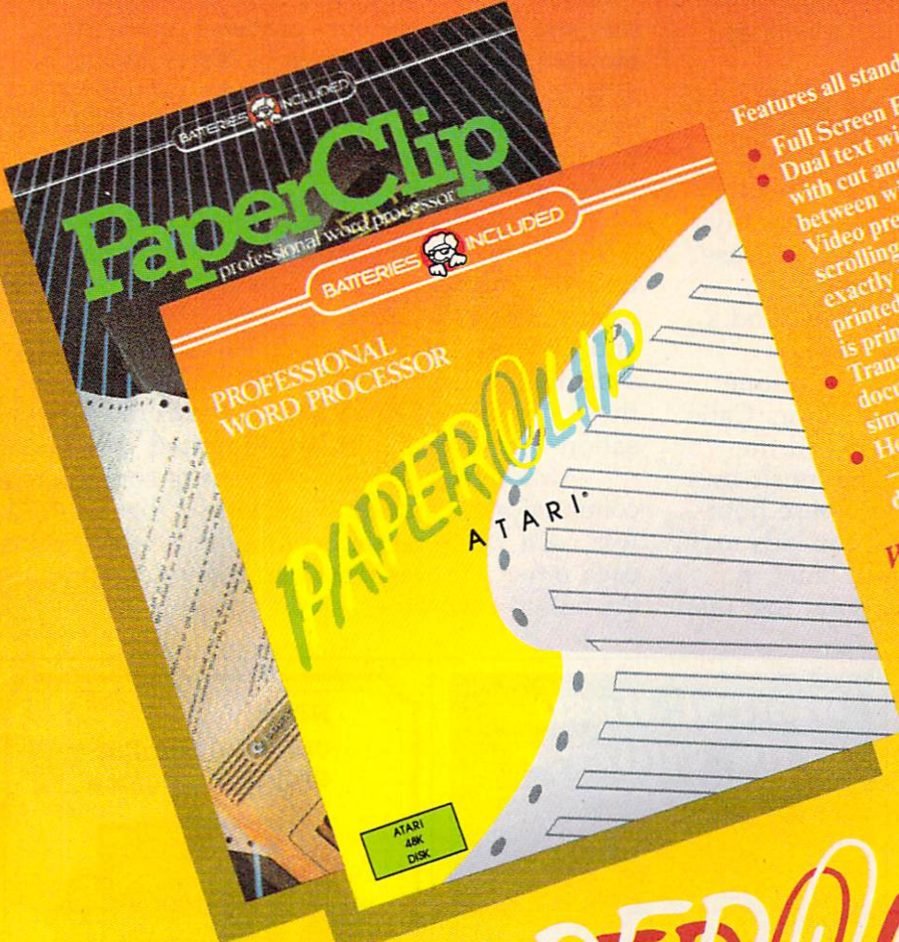

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E-Mail Away From Home

We have all become so dependent on this new avenue for family communication that when Janet or I go out of town we take a portable computer just to stay in touch. When we get to a hotel room or pay phone, we log onto a network, check our mailbox, and send letters to the rest of the family. The rest of the family, meanwhile, logs onto the computer two or three times a day and writes long, chatty letters to the traveling parent.

This system is far cheaper than making long-distance phone calls, and it's also better. For example, the other night Janet called us from Washington, DC, where she had been attending a conference for a week. She had been in daily touch by electronic mail, but she called because she wanted to hear our voices.

She got to hear our voices, all right. And a whole lot more. I was running the vacuum cleaner when she called and ran to the phone without turning it off. The TV was blaring. Catie and Eric had their friend Alexa over, and the three kids were playing breakdancing music on the stereo while racing through the house hooting and hollering. When I yelled at the kids to quiet down, the doorbell rang. I told Janet to wait a minute so I could go to the door. Just then the other telephone rang. Eric ran to get the phone and tripped over the vacuum cleaner and began crying.

When I got back to the phone a few minutes later, Janet was no longer in the mood to hear our voices. "I'll send you some E-mail," she said.

Epilogue

Most of these events happened during the summer and fall. Today our computer handyman, Howard, is a student down in New Orleans at Tulane, and things have calmed down around here considerably. The computers which fill the house still work, but not quite as well as when Howard was here.

We are still in love with electronic mail. We write to Howard every day on The Source, and he writes back. Janet and I have started sending each other electronic love letters. And Catie, Eric, and I have started exploring The Source's CHAT system and CompuServe's CB Simulator. Using these systems we can have an electronic conversation with over a hundred thousand people.

After our experience with using computers to communicate, I am firmly convinced that Howard was right when he said computers should talk to each other. He was right because when computers talk to each other, so do people. ©

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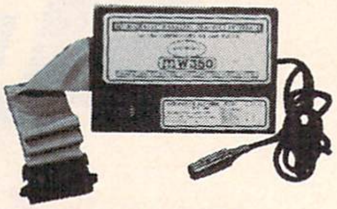

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Now-Silent Beethovens

Richard Mansfield, Senior Editor

Until very recently, automation has only crushed the minor arts, the crafts: candlemaking, weaving, pottery. Now music, a major art form, is about to become automated. This raises serious questions. What about musicians who've spent their lives practicing the violin? And if music, one of the most complex forms of human expression, can be made on a machine—what's next? Literature? Justice?

We've watched a rising tide of mechanization over the last century. The benefits of tractors were so obvious that few bemoaned the passing of hand plowing. Indeed, until recently, most automation has replaced unpleasant or dangerous *physical* jobs. Now, though, machines are proving adept at some of the more delicate mental activities upon which many people base their definition of human value.

The Fairlight, the Synergy, the Kurzweil—today's most advanced computerized music machines—can now automatically play as beautifully, for all practical purposes, as many musicians.

What's more, these synthesizers aren't just threatening to replace individual artists. A synthesizer can reproduce the sound of any instrument, even the sound of an entire orchestra playing in concert. Containing digitized recordings of real acoustic instruments, the new machines are the sonic equal of the finest handmade pianos, the best violins.

Synthesizers can be played like a piano: There's a keyboard, traditional sustain pedals, and so forth. In that mode, they still require an experienced keyboard artist to sound good.

But they have another mode: Driven by sequencers, a synthesizer can be preprogrammed. You sit down and teach the machine to memorize the music just the way you would program a computer. This programming can be done either by playing the pianolike keyboard or by typing into a computer keyboard. And you don't need dexterity. You can enter the notes at any speed. You don't even need a sense of rhythm. You can instruct the instrument to resolve the music into the degree of rhythmic accuracy that pleases you. Since total accuracy sounds mechanical, it's best to quantize slightly off the beat to create that human quality we've come to think of as warm and pleasing.

You can even buy entire musical pieces on floppy disks and just insert them into the synthesizer, push a button, and stand back. The instrument plays itself. And you'd be hard-pressed to tell you weren't listening to Bach on a concert grand.

It seems likely that synthesizers will follow the traditional path of most new technologies. Right now the best synthesizers cost between $10,000 and $40,000. Soon, however, the prices should be in the hundreds of dollars, and consequently, millions of people will have unprecedented access to creative play with music. It won't be necessary to struggle for years to learn to read musical notation, to play a difficult instrument, or to learn harmony or rhythm. All those things will be waiting behind buttons on these machines.

It won't be necessary to find others to form a band. You can, like Prince, play all the parts yourself. If you come up with something lovely, you won't need to buy an expensive multitrack tape recorder or, worse, spend a fortune at a professional recording studio. Inside these synthesizers is a full, multitrack, digital recorder. You become the engineer and can do everything from the editing of a single note to the transposition of the entire piece.

There is pain here though. Conductors, recording engineers, and professional musicians will be less frequently called upon. There will, of course, always be traditional instrumentalists, just as there will always be people hand-dipping candles and climbing mountains. But their efforts may be increasingly thought of as a trick rather than a talent, something pleasantly nostalgic, but, ultimately, eccentric.

Becoming a truly expert violinist has always been a kind of personal torture, but it had great value to society. Master violinists of the future will likely be admired in that strange way we admire people who can climb difficult mountains: admired more for their self-discipline than for any practical results of that discipline.

Nevertheless, with all the tools of music in every living room, with musical skills at everyone's fingertips that previously took a lifetime to develop, who knows how many now-silent Beethovens will suddenly rise and be heard across the world? ©

MSX IS COMING

Part 2: Inside MSX

Tom R. Halfhill, Editor

Last month, Part 1 of this special two-part series reported how more than a dozen companies—primarily Japanese—are preparing to invade the U.S. market with low-priced home computers based on a new standard called *MSX*. Already established in Japan, and just getting underway in Europe, MSX is expected on U.S. shores in early 1985. This month, Part 2 takes you inside MSX and evaluates the performance of a typical MSX home computer.

If you've been involved in personal computing very long, chances are you've heard of the RS-232 serial standard, the Centronics parallel standard, the CP/M standard, the IBM PC standard, the MS-DOS standard, and a few other standards.

Now there's a new one: *MSX*. What—if anything—sets MSX apart from all the others?

Here's the quick answer: MSX is perhaps the most workable standard of them all because it's the only *true* standard.

That statement is not as bold as it sounds. It simply means that MSX was designed from the very beginning as a complete hardware/software standard to be licensed to any manufacturers who want to participate. That concept alone sets MSX apart from all the other so-called standards in personal computing. The others are really de facto standards—they were adopted over the past eight years by accident or by default.

Consider a few examples. Until recently, CP/M (Control Program for Microcomputers) was the dominant operating system on business and high-end personal computers. Thousands of programs have been written for CP/M. You can run it on dozens of different machines, from battery-powered lap portables to desktop computers with multiple floppy drives and hard disks. In 1984, Commodore even released a plug-in cartridge that lets you run CP/M on its popular Commodore 64 home computer.

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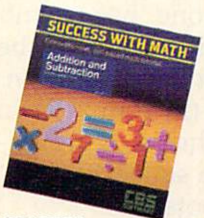

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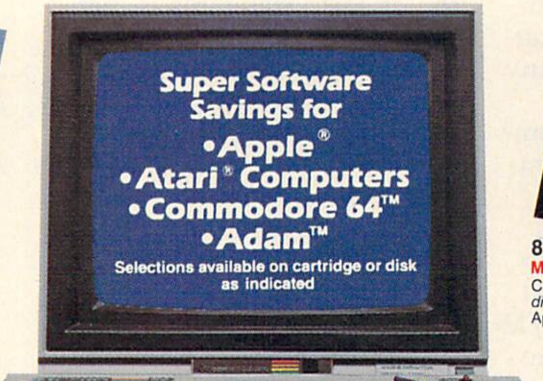

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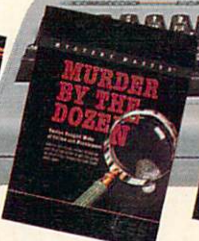

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How the Club works: about every 6 weeks (up to 9 times a year) you will receive the Columbia Software Club Magazine. In it you'll find out about an exciting variety of the newest software available: simple shoot-em-up adventures, more challenging strategy software, learning software to help the entire family acquire new skills—how to type, master basic math, budget your finances, and much more.

In addition, each issue of the magazine announces the "Pick-Hit Selection"—an outstanding software selection specifically for your system. If you want only this Selection, you need do nothing—it will be sent to you automatically. If you want one of the alternate selections—or nothing at all—just tell us so on the response card always provided, and mail it by the date indicated. You'll always have ten days to make your decision. If you ever receive a selection without having had ten days to decide, you may return it at our expense.

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It would seem that any computer which could run CP/M could also run CP/M programs, but it's not always that easy. For instance, a Commodore 64 with the CP/M cartridge can theoretically run any CP/M program—if you can load the program into the computer. Unfortunately, the Commodore disk format is not compatible with other CP/M disk formats. So you can't just stick a CP/M disk into a 1541 disk drive and load up a CP/M program, even though the program would probably run if you could. Instead, you have to wait for someone to make the program available on a Commodore disk.

Or consider the IBM Personal Computer standard. Since the IBM PC was introduced in 1981, it has emerged as the dominant machine for business computing. PC-compatible computers made by independent manufacturers abound. MS-DOS and PC-DOS—close relatives to each other—have dethroned CP/M as the ruling operating systems. More than a thousand programs have been written. But none of the so-called IBM-compatible computers are really 100 percent compatible, because IBM aggressively defends its copyrights and patents (as it has every right to do). When other manufacturers copy the IBM PC too closely, they can wind up in court. When they don't copy it closely enough, they can wind up out of business.

Even IBM's own computers within the PC line are not fully compatible. Some PC programs just don't run on the PCjr—including IBM Disk BASIC. The Portable PC has encountered a few difficulties too.

Likewise, just because a printer or some other peripheral has a Centronics-standard parallel port or an RS-232-standard serial port doesn't mean it will match perfectly with the parallel or serial port on your computer. Quite often there are interfacing problems with connectors and so forth.

The basic problem with all the de facto standards is that, because they were developed more or less haphazardly and were not thoroughly and rigidly defined (or adhered to), they aren't true standards. And that's exactly what MSX aims to change. The main question is: How well will it succeed?

> ***The MSX designers chose technology which is relatively simple, proven, and cheap.***

Although MSX is primarily backed by Japanese consumer electronics and computer companies, it was invented by an American company—Microsoft, Inc. (See Part 1 in last month's COMPUTE!.) *MSX* stands for *Microsoft Extended.* As the name implies, MSX is an extension of current technology rather than an entirely new technology.

Whenever someone sets out to design a new standard, the first decision they face is whether to make it compatible with existing technology, to discard old restrictions to take full advantage of new technology, or to strike some sort of balance. The MSX designers struck a balance.

Trying to create a standard for home computers, not for expensive business or high-end personal computers, the MSX designers chose technology which is relatively simple, proven, and cheap. It's sufficient to get the job done, but technological overkill it's not. Still, because the technology has been around so long (in computer industry terms), the MSX designers were able to squeeze out every drop of potential performance.

The MSX standard is based on the following components and specifications:

- Zilog Z80A Central Processing Unit (CPU)—an eight-bit microprocessor chip clocked at four megahertz.
- 32K of Read Only Memory (ROM), containing MSX BASIC and the Basic Input/Output System (BIOS).
- 8K minimum Random Access Memory (RAM), with 64K recommended for the U.S. and European markets.
- 16K of video RAM (screen memory). This is in addition to user RAM.
- Texas Instruments TMS9918A video chip, which provides several text modes ranging from 29 columns × 24 rows to 40 columns × 24 rows; 256 redefinable characters (6 × 8 pixels), including alphanumeric, European, and graphic characters; several graphics modes, with a maximum resolution of 256 × 192 pixels; 16 colors; and 32 sprites (maximum four per horizontal line). This is the same video chip found in the TI-99/4A computer and the Coleco Adam.
- General Instruments AY-3-8910 programmable sound chip, providing three sound channels covering eight octaves with 12-bit frequency resolution. This is the same sound chip found in the TI-99/4A, Coleco Adam, and IBM PCjr. The chip also controls input/output via the joystick controller port (at least one Atari-type port required).

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- Keyboard with at least 70 keys, including separate cursor-control keys, screen editing keys, five special function keys which can be shifted to provide ten functions, and keys to shift the keyboard into graphic and special character sets. (But no numeric keypad.)
- MSX-DOS floppy disk drive interface. Although the hardware interface is not necessarily standardized, the disk format is: MS-DOS. That means an MSX drive can read disks formatted on an IBM PC or PC-compatible. Formats are standardized for 8-inch, 5¼-inch, 3½-inch, and 3-inch disks. MSX-DOS requires a system with at least 64K RAM.
- Cassette interface using frequency shift keying format, selectable 1200/2400 baud.
- Standardized cartridge slot sizes, expansion addressing schemes, pin assignments on all interfaces, signal levels on all pins, memory maps, operating system entry points, RAM vectors, etc.

The above specifications are the *minimum MSX requirements*. Beyond them, MSX defines "standardized optional extensions" and also leaves manufacturers free to add enhancements of their own—as long as they don't interfere with the standards. The standardized extensions include an 80-column text mode, RS-232 serial port, parallel printer port, and a battery backed-up CMOS clock. Enhancements seen to date range from videodisc-mixing interfaces to instrument-quality music synthesizers—features that are either unavailable or much more expensive on American personal computers which claim to be more advanced technologically than MSX.

The enhancements are significant from a marketing as well as a technological standpoint. Since all MSX computers are basically the same, any extras added by each manufacturer serve to differentiate their models in the marketplace. Usually these extras reflect the manufacturer's expertise in other areas of consumer electronics. For example, JVC's MSX computer has a videodisc interface which can mix video and computer graphics on the screen simultaneously. The result is videogames and interactive educational programs with stunning realism.

> ***Manufacturers are free to add enhancements—as long as they don't interfere with the standards.***

A Yamaha MSX machine—the CX5M Music Computer—has a built-in synthesizer that puts even the Commodore 64 SID chip to shame. With its MIDI (Musical Instrument Digital Interface) jack and two optional music keyboards, the CX5M may find as many buyers among musicians as among computer hobbyists.

Another important MSX feature is the software compatibility of MSX-DOS. You might think that because MSX-DOS uses the same disk format as MS-DOS, it should run MS-DOS software. But it doesn't—remember, MS-DOS is an operating system for 16-bit computers. Instead, MSX-DOS is designed to run software written for the most popular eight-bit operating system: CP/M-80 2.2. This opens up a huge library of existing programs, including business and professional programs such as *Multiplan*. This partially answers the frequent criticism that most MSX software is game-oriented. However, exactly how much CP/M software is compatible with MSX-DOS remains to be seen.

In theory, then, MSX seems like an organized, carefully constructed standard. But the real world is messy. How workable is MSX in practice? After all, inventing a standard is the relatively easy part; the strict compliance that's necessary to keep it viable is much harder.

In Japan, where MSX made its debut in late 1983, it seems to be working well. Hundreds of thousands of machines have been sold, capturing a significant share of the home market, even though Japanese MSX computers are rarely equipped with disk drives or more than 16K RAM. Hundreds of cartridge programs have been released—mostly games—and all the cartridges are fully compatible with all the MSX machines (more than a dozen different brands). Japanese computer magazines publish programs in MSX BASIC and machine language that run on every MSX computer without modification.

Two enforcers guard the software and hardware gates of the MSX standard. First, marketing pressure: No software publisher wants to narrow its potential market by writing a program which is compatible with some MSX computers, but

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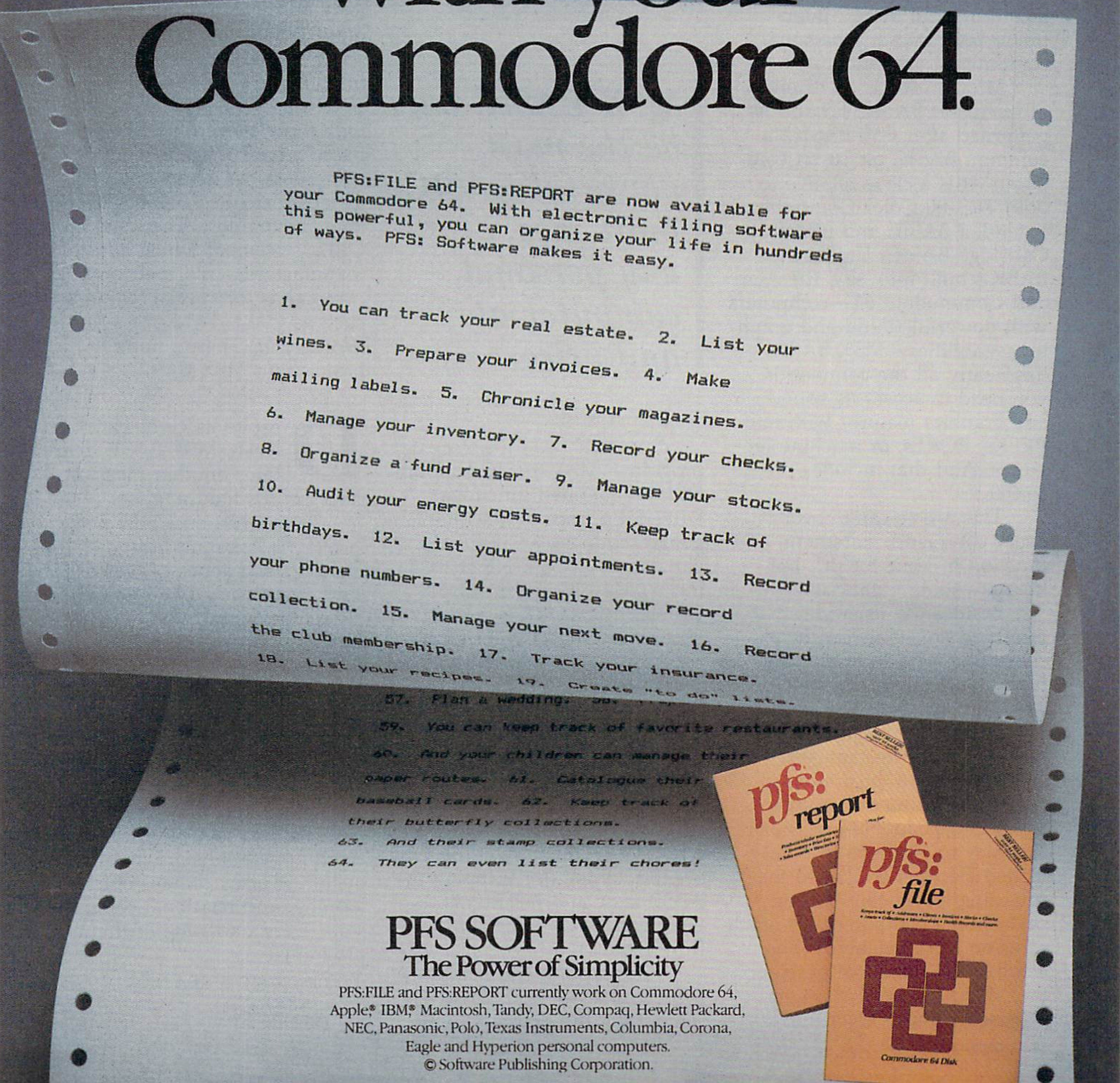

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not others. Second, legal pressure: MSX licensees must comply with Microsoft's minimum MSX specifications to use the MSX label on their computers. So adherence to the standard seems virtually guaranteed.

Although the MSX hardware seems unlikely to win any awards for advanced technology, the designers have extracted maximum performance with some impressive system software. In fact, MSX BASIC may well be the most powerful BASIC interpreter built into any personal computer at any price.

MSX BASIC is an extension of Microsoft BASIC 4.5 and is patterned after GW-BASIC, a common BASIC on 16-bit computers. It is a close relative to both TRS-80 Color Computer Extended BASIC and IBM PCjr Cartridge BASIC. Unlike the BASICs built into, say, the Atari and Commodore 64—computers with powerful sound and graphics capabilities—MSX BASIC has nearly all the commands you need to access its sound and graphics features without PEEKs, POKEs, or machine language. And that includes the sprites.

This article can't cover every command, statement, and function in MSX BASIC, but here are some highlights:

Besides the usual decimal numbers, constants can be expressed in hexadecimal, octal, or binary with the prefixes &H, &O, and &B. Variables can be any length, two characters significant, and either integer, single-precision, or double-precision. Arithmetic is performed with double-precision accuracy to 14 digits in Binary Coded Decimal (BCD), so the rounding errors common on other home computers are much rarer on MSX machines. There's a full set of relational operators (=, <, >, <>, <=, >=) and bitwise operators (NOT, AND, OR, XOR, EQV, IMP). Line numbers can range from 0 to 65529.

MSX BASIC has full-screen editing similar to Commodore, Atari, and IBM computers. The ten special function keys are preprogrammed with BASIC commands and can be redefined by the user. Auto line numbering and renumbering are built-in. TRON/TROFF commands let programmers trace a program as it executes, and ERROR lets them trap bugs from within programs. MSX BASIC supports DEF FN (defined functions); DEFUSR (jumps to machine language routines); array ERASE; variable CLEAR; LINE INPUT; PRINT USING and LPRINT USING; RESTORE to a line number; RESUME after error; SWAP variable values; conversions between decimal, hex, octal, and binary constants; VARPTR (variable address pointer); numerous string manipulators; KEY, KEY LIST, KEY ON/OFF, and ON KEY GOSUB (for the function keys); STOP ON/OFF/STOP and ON STOP GOSUB (for trapping the STOP key); and INTERVAL ON/OFF/STOP (interrupts from BASIC).

> ***MSX BASIC may be the most powerful BASIC built into any personal computer at any price.***

For graphics and sound, MSX BASIC supports SCREEN (for setting the graphics mode and other options), LOCATE (to specify a character position for PRINT), POINT (to determine the color of a specified pixel), COLOR (for setting screen colors), CIRCLE, DRAW, LINE, PAINT (a fill command), SPRITE$ (to define a sprite), SPRITE ON/OFF/STOP, PUT SPRITE, VPEEK and VPOKE (PEEK and POKE video RAM), BEEP, PLAY, and SOUND. Other interesting functions are STICK (read the joystick), STRIG (read the joystick button), PDL (for paddle controllers), and PAD (to interpret input from a touch tablet).

There are many more features, but from this overview it's clear that MSX BASIC is not only more powerful than the BASICs built into other home computers, it's also as powerful as most extended BASICs available at extra cost. There's even a CALL statement which lets manufacturers add their own commands for special features, such as CALL TALK for a voice synthesizer. There's nothing basic about MSX BASIC.

Despite its eight-bit leash, MSX BASIC contains another pleasant surprise: It's lightning fast.

To measure just how fast, COMPUTE! Assistant Editor Philip Nelson ran a series of benchmark tests using a simple bubble sort program. The program was written in plain-vanilla BASIC so it would run unmodified on a variety of popular computers. It creates a numeric array of 150 elements which are then sorted. Although this certainly isn't the most thorough benchmark test that could be devised, it is revealing. Several typical operations are involved, including array dimensioning, looping, and relational comparisons. Here's a listing of the test program:

```
100 PRINT "CREATING
   ARRAY"
110 DIM A(150)
```

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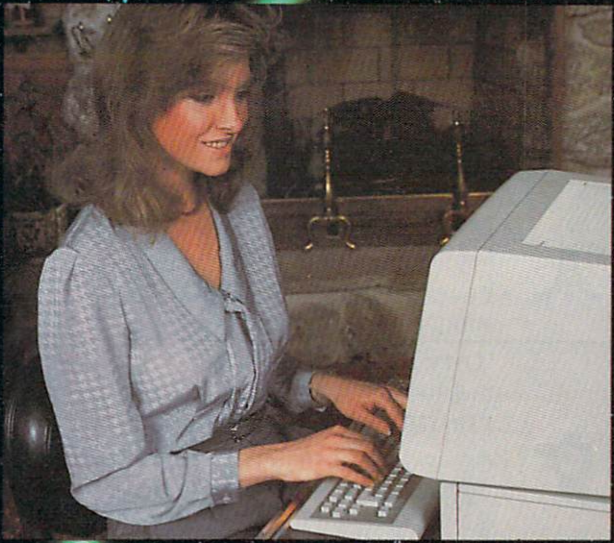

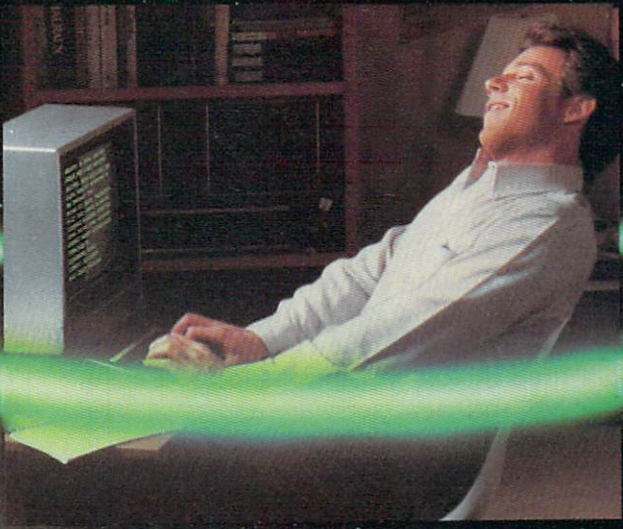

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```
120 FOR J=1 to 150
130 A(J)=151-J
140 NEXT J
150 PRINT "SORTING"
160 EX=0
170 FOR K=0 TO 149
180 IF A(K)>A(K+1) THEN T=A(K):A(K)=A(K+1):
    A(K+1)=T:EX=1
190 NEXT K
200 IF EX<>0 THEN GOTO 160
```

The only changes made to this program were double colons in line 180 as required for the TI-99/4A. Following are the test results expressed in minutes:seconds.

IBM PC	5:45
GoldStar MSX	6:20
Apple II Plus	6:24
Apple IIc	6:33
Commodore VIC-20	6:34
IBM PCjr	6:59
Commodore 64	7:02
Commodore 8032	7:16
TRS-80 Color Computer	8:01
Commodore 16	8:35
Commodore Plus/4	8:36
Atari 800XL	8:55
Atari 800	9:00
TI-99/4A	12:58

The specific results of this test aren't as important as the general conclusion. Although an MSX-based computer (and virtually any machine designed earlier than about two years ago) could be termed technologically ancient, the streamlined performance of the MSX is nothing to sneeze at.

Nevertheless, it remains difficult to predict whether or not MSX will succeed in America. Will consumers in 1985 be impressed with its affordable features, or bored by its technology? Both Commodore and Atari are expected to introduce new 16-bit or even 32-bit home computers at the same Winter Consumer Electronics Show where MSX will probably debut in January. Will these machines make MSX look even more tired in comparison? As long as a home computer has sufficient software and power to get the job done, does it matter to the average user if it contains an 8-bit or a 32-bit CPU?

Will MSX succeed because of the compatibility solution it offers? Are consumers tired of new computers that won't run anybody else's software? Or will they prefer the latest hot-technology machines, even if it means waiting for software?

If MSX does prevail, how will competitors react? Will they resist the standard or join it?

After IBM's recent tribulations with the PCjr, and the brick walls that TI, Atari, Mattel, and Coleco ran into in the fast lane, nothing is certain anymore in the home computer market. ©

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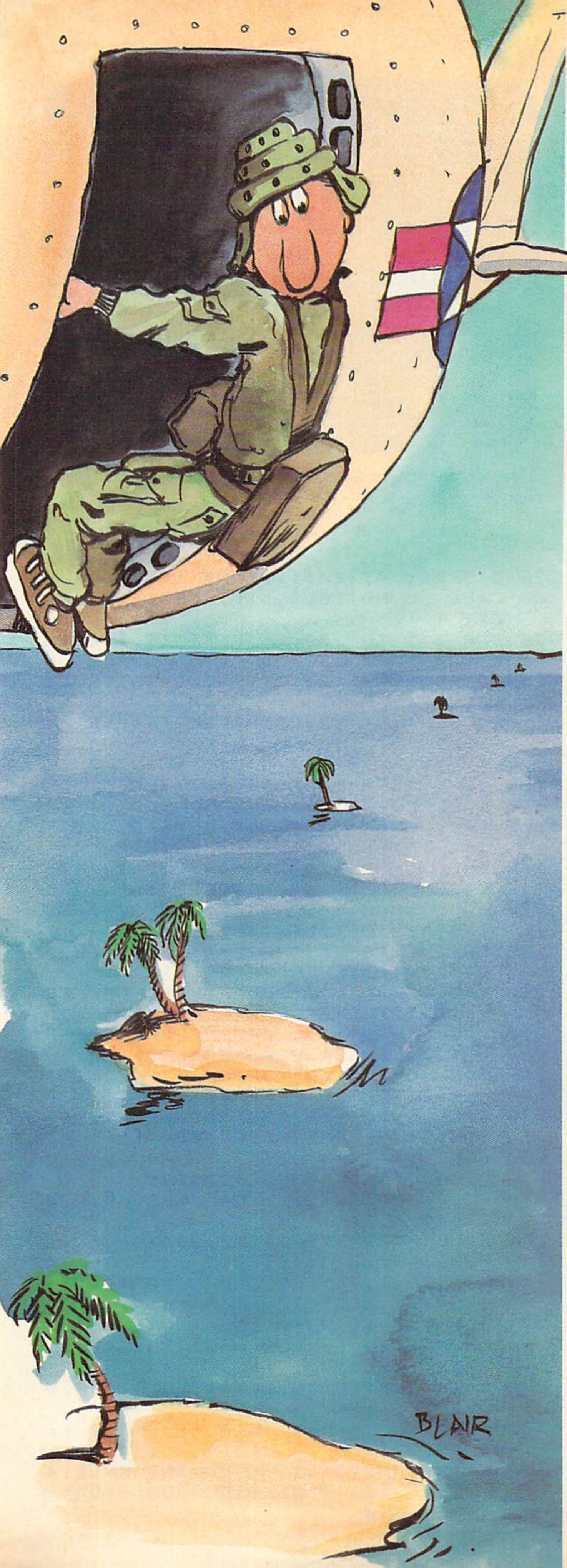


"Paratrooper" is a game of high responsibility—you control the destiny of ten parachutists, giving the go signal that ejects them from the plane. Their safe landings depend on your ability to judge weight factors, windage, and the all-important crucial moment when they should leap. Originally written for the TI-99/4A (with 16K and Extended BASIC), the program has been adapted for the Commodore 64, unexpanded VIC, Atari (with at least 32K), Apple, IBM PC (with color/graphics adapter and BASICA), PCjr (with Cartridge BASIC), and the Commodore Plus/4 and 16.

Paratrooper

John Goetz

Almost everyone has seen a parachuting exhibition. Perhaps you've wished that you, too, could fall from the sky on the wings of the wind. The plane drones on, cruising at the proper altitude. You peer out the hatch through wispy remnants of clouds as you decide where to land. You can barely see three tiny squares, far below, surrounded by water. These must be the landing pads, your drop zones. An aquatic landing can lead only to disgrace and severe embarrassment, so you know that you must jump at just the right moment.

There are three different-sized landing pads: The smaller pads promise the greatest honor and reward, but allow less room for error. Nearby, graceful sailboats ply the water. You know that soon these tiny features will grow at an alarming rate. You consult with the pilot and estimate the perfect moment for your jump by carefully considering your altitude, the speed of the wind, and your own body weight.

Too many late-night pizzas coupled with a low wind speed, and you'll drop like a stone. But if you're a featherweight, and the wind's kicking up, you'll find yourself drifting quite a way. With all the facts in, you wait for just the right moment. Then you leap out into the cold, crisp wind—with fingers crossed, of course.

If even reading this description makes you nervous, you'll be glad "Paratrooper" is just a computer game. Rarely is such a simple game so fun to play. The single key (or joystick) control and adjustable difficulty levels makes this an easy to learn, yet challenging, game for young children too.

Let Your Fingers Do The Jumping

The various versions of Paratrooper differ slightly, but the concept is the same. Your plane continuously flies across the screen at an altitude which changes randomly for each jump. The paratroopers' weights and the wind speed change for each jump, too. All this information is displayed on the screen. You have ten paratroopers: ten chances for glory, or ten chances for dripping disaster. To drop a trooper, press any key (on the TI-99/4A, press Q or the fire button on joystick 1). The three landing pads are worth 25, 50, and 75 points, depending on their size.

All versions have more than one difficulty level. The TI version lets you choose between Novice and Experienced at the start of the game (you must rerun the program to change the level). The plane always moves at the same speed, but the landing pads are smaller in the Experienced level. Versions for the IBM, Atari, Plus/4, Commodore 16, and VIC-20 let you choose between Novice and Expert—again, the plane travels at the same speed, but the landing zones get smaller. The Commodore 64 version adds an Intermediate level. The Apple version has Easy and Hard levels, and the plane flies faster on the Hard level while the landing pads remain the same size.

Special Instructions

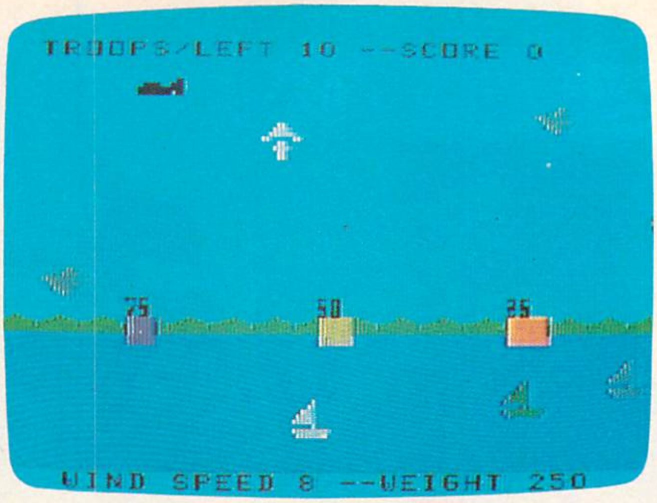
After typing in the Atari version (Program 5), it's important to save it on tape or disk before running it for the first time. Before loading the game, clear the computer by turning it off, then on again, and type POKE 128,0:POKE 129,64: NEW and press RETURN. This rearranges memory to make room for a machine language subroutine.

The VIC-20 version is broken into two parts so it works on an unexpanded VIC. Type in Program 3 and save it to tape or disk. If you are using tape, be sure to change the 8 to a 1 in line 40 of Program 3. Type in and save Program 4 as "P2" (for Part 2). Save Program 4 immediately after Program 3 on the tape.

Program 1: Paratrooper For TI-99/4A

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 REM EXTENDED BASIC REQUIRED
20 CALL CLEAR
30 FOR T=10 TO 14 :: FOR I=10 TO 14
    :: DISPLAY AT(12,9):"PARATROOPE
   R"
40 CALL SCREEN(T):: NEXT I :: NEXT
   T
50 CALL CHAR(131,"183C7EC3183C1818"
   ):: CALL SCREEN(12)
60 FOR T=450 TO 550 STEP 50 :: FOR
   I=9 TO 19
```



A paratrooper leaps for the landing pads in the TI version of "Paratrooper."

```
70 DISPLAY AT(14,I):CHR$(131)
80 CALL SOUND(10,T,3):: NEXT I :: N
   EXT T
90 FOR I=1 TO 100 :: NEXT I :: GOSU
   B 920
100 DISPLAY AT(22,2):"NEED INSTRUCT
    IONS?(Y/N)"
110 ACCEPT AT(22,25)VALIDATE("YNyn"
    ):Y$
120 IF (Y$="Y")OR(Y$="y")THEN 750
130 IF (Y$="N")OR(Y$="n")THEN 860
140 CALL CLEAR :: CALL SCREEN(8)
150 CALL CHAR(33,"E7A424E7E781A5E7"
    ,34,"E78585E5E525A5E7")
160 CALL CHAR(37,"F794141727614147"
    ,42,"503D7C7C7C7A0088D")
170 CALL CHAR(43,"183C7DC300000000"
    ,44,"08183878F808FF7E")
180 CALL CHAR(46,"187E5A183C000000"
    ,98,"01031FFFFFFFFFFF")
190 CALL CHAR(99,"80C0FCFDFDFFFFFF
    ",107,"FFFFFFFFFFFFFFFF")
200 CALL CHAR(117,"FFFFFFFFFFFFFFFF
    ",122,"00E0A6E6A6FEBAEE")
210 CALL CHAR(130,"00000173FFFD0000
    ",133,"FFFFFFFFFFFF0000")
220 CALL CHAR(134,"FCFCFCFCFCFC0000
    ",135,"FEFEFEFEFEFE0000")
230 CALL CHAR(137,"183C7E7EFFFF1818
    ",143,"0E5FFE7F3E1C0800")
240 CALL SCREEN(8):: CALL COLOR(9,4
    ,8,10,6,1)
250 CALL HCHAR(16,1,107,256)
260 FOR I=1 TO 31 STEP 2 :: CALL HC
    HAR(16,I,98):: CALL HCHAR(16,I+
    1,99):: NEXT I
270 POINT=0 :: PARA=10
280 RANDOMIZE :: FOR N=22 TO 24 ::
    G=INT(RND*100)+10
290 CALL SPRITE(#N,143,15,G,G+120,0
    ,.60):: NEXT N
300 S=7 :: FOR N=4 TO 6 :: S=S-1 ::
     RANDOMIZE
310 D=INT(RND*5)+1 :: DD=INT(RND*14
    )+3 :: IF (D=OD)+(DD=ODD)+(DD=6
    )THEN 310
```

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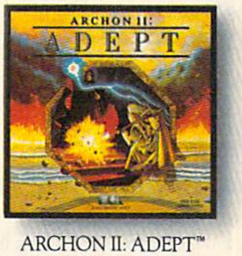

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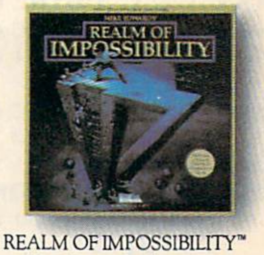

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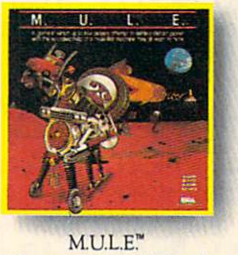

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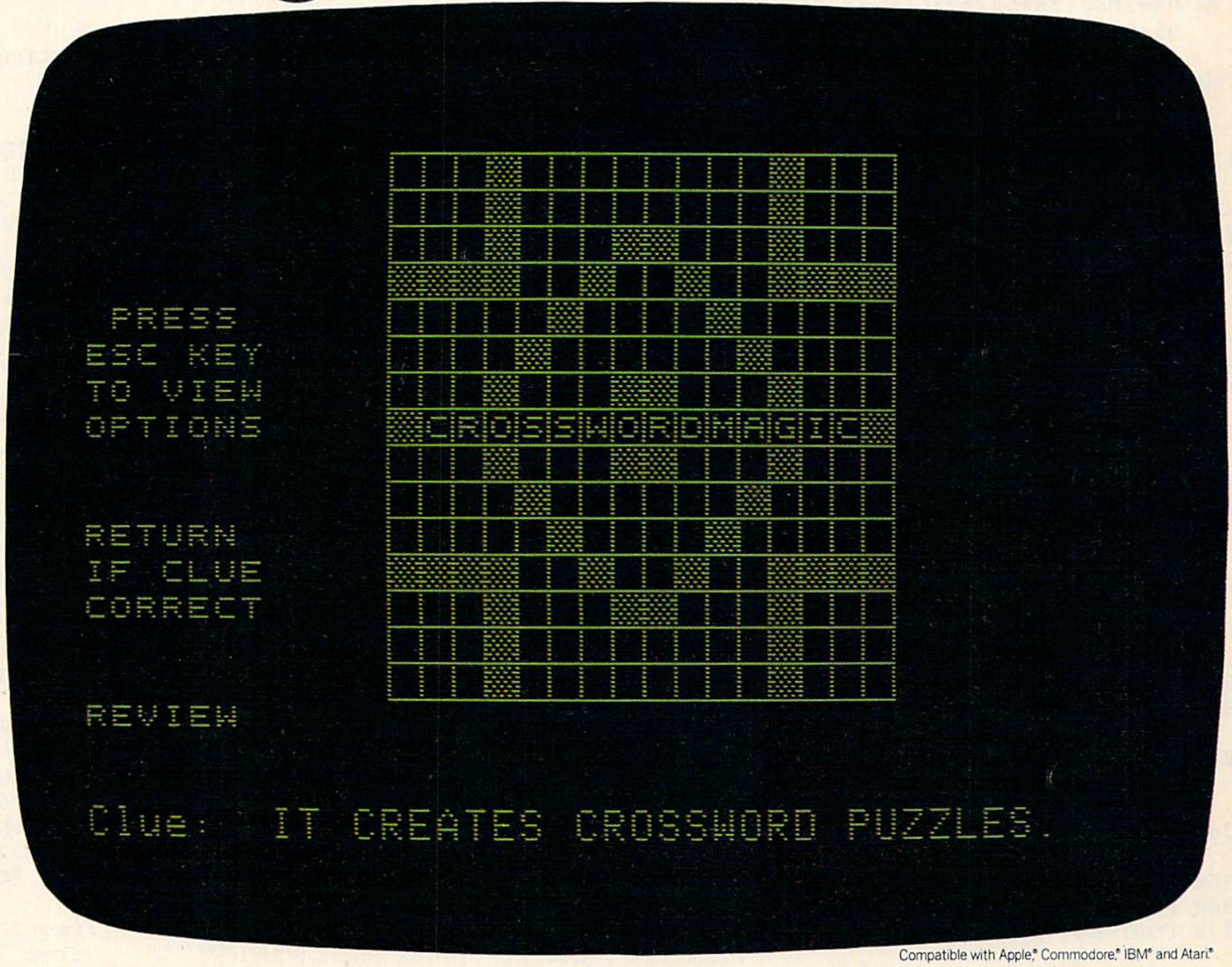
```
320 OD=D :: ODD=DD :: J=N*10+90+RND
    *10 :: CALL SPRITE(#S,44,DD,J,J
    ,0,D):: NEXT N
330 IF FL=1 THEN 370 ELSE DISPLAY A
    T(15,5):CHR$(37):: DISPLAY AT(1
    5,14):CHR$(34)
340 DISPLAY AT(15,23):CHR$(33)
350 CALL SPRITE(#3,32,1,180,180,0,6
    0):: REM INVISIBLE OCEAN SPRITE
360 CALL SPRITE(#7,133,10,121,193,#
    8,135,12,121,121,#9,134,14,121,
    49):: REM PADS
370 IF PARA=0 THEN 630 ELSE RANDOMI
    ZE :: U=INT(RND*70)+10 :: REM P
    LANE ROW
380 CALL SPRITE(#1,130,2,U,10,0,-12
    ,#2,130,16,U,7,0,-12):: REM PLA
    NE & TROOPER
390 V=INT(RND*9)+1 :: L=INT(RND*4)+
    1 :: REM WEIGHT & WIND FACTORS
400 DISPLAY AT(1,1):"TROOPS/LEFT";P
    ARA;"--SCORE";POINT
410 DISPLAY AT(24,2):"WIND SPEED";L
    *2;"--WEIGHT";(V*25)+50
420 CALL KEY(1,X,Y)
430 IF X=18 THEN CALL PATTERN(#2,13
    1)ELSE 420
440 CALL MOTION(#2,V,L):: CALL SOUN
    D(30,-6,5,150,5)
450 CALL COINC(#2,#7,Z,C)
460 CALL COINC(#2,#8,Z,CC)
470 CALL COINC(#2,#9,Z,CCC)
480 IF (C=-1)+(CC=-1)+(CCC=-1)THEN
    510
490 CALL COINC(#2,#3,50,R):: IF R=-
    1 THEN 570
500 GOTO 450
510 CALL MOTION(#2,0,0):: CALL PATT
    ERN(#2,46):: CALL SOUND(-1500,5
    995,4)
520 FOR T=950 TO 1500 STEP 50 :: CA
    LL SOUND(50,T,3):: NEXT T
530 POINT=POINT-25*(C=-1)-50*(CC=-1
    )-75*(CCC=-1)
540 CALL DELSPRITE(#1,#2):: DISPLAY
     AT(13,5):"MISSION ACCOMPLISHED
    "
550 FOR I=1 TO 150 :: NEXT I
560 CALL HCHAR(13,5,32,22):: GOTO 3
    70
570 CALL MOTION(#2,0,0):: CALL SOUN
    D(200,-4,3):: CALL PATTERN(#2,4
    3)
580 FOR I=1 TO 200 :: NEXT I :: CAL
    L PATTERN(#2,42)
590 CALL DELSPRITE(#1,#2):: DISPLAY
     AT(13,3):"YOU MISSED THE DROP
    ZONE"
600 POINT=POINT-10 :: PARA=PARA-1
610 FOR I=1 TO 150 :: NEXT I :: CAL
    L HCHAR(13,3,32,26)
620 GOTO 370
630 CALL HCHAR(1,1,32,29):: CALL HC
    HAR(24,1,32,29)
640 FOR I=450 TO 850 STEP 25 :: CAL
    L SOUND(50,I,3):: NEXT I
650 FOR T=850 TO 450 STEP -25 :: CA
    LL SOUND(50,T,3):: NEXT T
660 DISPLAY AT(7,10):"GAME OVER"
670 DISPLAY AT(9,6):"YOU HAD ";POIN
    T;"POINTS"
680 DISPLAY AT(12,2):"WANT TO PLAY
    AGAIN? (Y/N)"
690 ACCEPT AT(12,27)VALIDATE("YN"):
    R$
700 IF R$="N" THEN 730
710 CALL HCHAR(12,4,32,26):: CALL H
    CHAR(7,12,32,9):: CALL HCHAR(9,
    6,32,24)
720 FL=1 :: GOTO 270
730 CALL CLEAR :: CALL DELSPRITE(AL
    L):: CALL SCREEN(14):: DISPLAY
    AT(12,10):"GOOD BYE  "
740 GOSUB 920 :: END
750 CALL CLEAR :: CALL SCREEN(12)
760 PRINT "LAND YOUR PARATROOPERS O
    N","DROP PADS WORTH 75, 50, OR"
770 PRINT "25 POINTS. RELEASE EACH"
    ,"WITH THE FIRE BUTTON ON","JOY
    STICK #1 OR THE {Q} KEY.": :
780 PRINT "IF YOU MISS, YOU WILL DR
    IFT","INTO THE OCEAN AND LOSE 1
    0"
790 PRINT "POINTS. YOU CAN ONLY LOS
    E","10 TROOPERS BEFORE THE","GA
    ME ENDS.": : :: PRINT "THE WIND
     SPEED AND WEIGHT"
800 PRINT "OF EACH TROOPER ARE DIS-
    ","PLAYED AT THE BOTTOM OF THE"
    ,"SCREEN. CONSIDER THE SPEED"
810 PRINT "OF DESCENT AND THE DRIFT
    --"
820 PRINT "CHECK THESE BEFORE RELEA
    SING","EACH PARATROOPER.": :
830 PRINT TAB(10);"GOOD LUCK!": :
840 PRINT TAB(4);"PRESS ANY KEY TO
    BEGIN"
850 CALL KEY(0,K,S):: IF S=0 THEN 8
    50
860 CALL CLEAR :: DISPLAY AT(8,6):"
    PARATROOPER RANK ?"
870 DISPLAY AT(11,2):"<N>OVICE OR <
    E>XPERIENCED"
880 ACCEPT AT(8,24)VALIDATE("EN"):C
    $
890 IF C$="E" THEN 910
900 CALL MAGNIFY(2):: Z=10 :: GOTO
    140
910 Z=5 :: GOTO 140
920 CALL SOUND(300,330,3):: CALL SO
    UND(300,392,3)
930 CALL SOUND(500,392,3):: CALL SO
    UND(200,349,3)
940 CALL SOUND(100,330,3):: CALL SO
    UND(200,294,3)
950 CALL SOUND(300,330,3):: CALL SO
    UND(300,349,3)
960 CALL SOUND(300,370,3):: CALL SO
    UND(300,392,3)
970 CALL SOUND(250,440,3):: CALL SO
    UND(150,524,3)
980 CALL SOUND(500,524,3)
990 CALL SOUND(300,583,3):: CALL SO
    UND(100,523,3)
1000 CALL SOUND(200,440,3):: CALL S
     OUND(300,392,3)
1010 RETURN
```

Only one program lets you create your own crossword, instead of filling in someone else's.



```
  PRESS
ESC KEY
TO VIEW
OPTIONS

RETURN
IF CLUE
CORRECT

REVIEW

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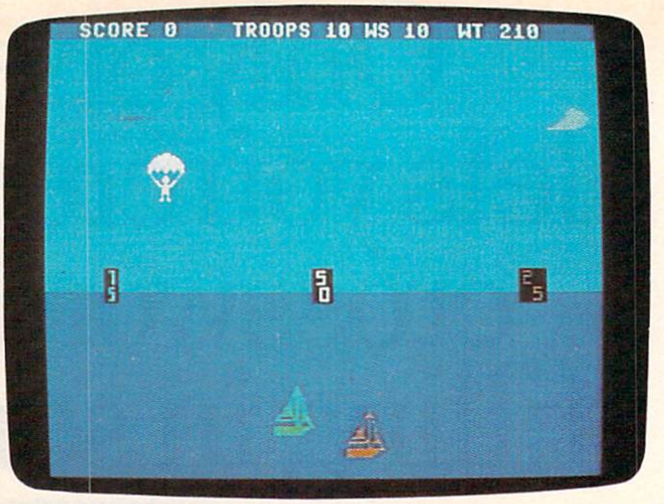
Program 2: Paratrooper For Commodore 64

Version by Gary Black, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

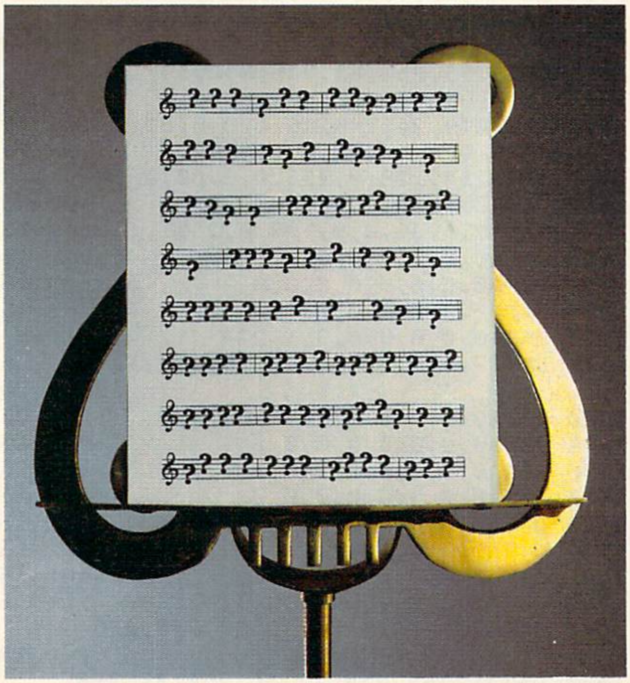
```
100 PRINT"{CLR}{5 DOWN}"TAB(13)"PLEASE WA
    IT":JS=56320                  :rem 29
110 FORI=1TO1016:READA:CH=CH+A:NEXT I
                                 :rem 237
120 IFCH<>67163THENPRINT"INCORRECT DATA":
    END                            :rem 2
130 RESTORE                      :rem 184
140 GOSUB930                     :rem 177
150 A$="{HOME}{39 SPACES}"       :rem 143
160 SC=0:TR=10:MB=53264:XP=53248:YP=XP+1:
    XA=YP+1:YA=XA+1:JS=56320:SD=12288
                                 :rem 173
170 PR=2040:EN=53269:CD=53278:CL=194:SH=1
    95:PL=193:PA=192:CR=53287:S=54272
                                 :rem 227
180 GOSUB630:GOSUB370:FORI=53250TO53256ST
    EP2:POKEI,INT(RND(0)*255):NEXT
                                 :rem 128
190 FORI=YPTOYP+14STEP2:READA:POKEI,A:NEX
    T                             :rem 41
200 GOSUB 690                    :rem 177
210 GOSUB650:GOSUB530              :rem 0
220 POKEEN,254:POKE53276,224:POKE53258,35
    :POKE53260,170:POKEMB,32:POKE53262,50
                                   :rem 7
230 REM ***** START GAME *****   :rem 197
240 SYS49360                     :rem 155
250 WS=INT(RND(0)*10)+1:WT=INT(RND(0)*225
    )+75:GOSUB530:POKE49155,11-WS :rem 75
260 POKE49156,11-WS:GETB$:IFB$=""THEN260
                                  :rem 44
270 REM *** JUMP! ****             :rem 0
280 D=PEEK(CD):POKEMB,(PEEK(MB))OR((PEEK(
    MB)AND2)/2):PX=PEEK(XA):PY=PEEK(YA)+2
    1                             :rem 44
290 POKEXP,PX:POKEYP,PY:POKEEN,255:GOSUB8
    80:DX=WS/7:DY=WT/200         :rem 238
300 POKEXP,PX:POKEYP,PY:HT=INT(RND(0)*20)
    +170                          :rem 40
310 PY=PY+DY:IFPY>HTTHENGOTO440   :rem 55
320 PX=PX+DX:IFPX>255THENPX=0:POKEMB,PEEK
    (MB)OR1                      :rem 115
330 IF(PX>80)AND((PEEK(MB)AND1)=1)THENPX=
    10:POKEYP,0:POKEMB,PEEK(MB)AND254
                                  :rem 42
340 TP=PEEK(CD):IF(TPAND1)THENIF(TPAND224
    )THENIFPEEK(YP)<=141THEN560   :rem 11
350 GOTO300                      :rem 100
360 REM**READ IN SPRITE DATA**   :rem 201
370 FORI=SDTOSD+767:READA:POKEI,A:NEXT
                                 :rem 214
380 POKEPR,PA:POKEPR+1,PL:POKEPR+2,CL:POK
    EPR+3,SH:POKEPR+4,SH         :rem 220
390 IFA$="N"THEN410               :rem 35
400 POKEPR+5,196:POKEPR+6,197:POKEPR+7,19
    8                              :rem 5
410 POKECR,1:POKECR+1,11:POKECR+2,15:POKE
    CR+3,8:POKECR+4,5:POKECR+5,2 :rem 197
420 POKECR+6,7:POKECR+7,3:RETURN :rem 247
430 REM**BAD LANDING**           :rem 231
440 POKEPR,200:GOSUB850:PRINTA$"{HOME}
    {10 SPACES}TROOPER MISSED TARGET"
                                 :rem 184
450 FORI=1TO1000:NEXT:PRINTA$:POKEEN,254:
    TR=TR-1:SC=SC-10              :rem 85
```



Commodore 64 "Paratrooper" has three levels of difficulty; this is the hardest level with the smallest landing pads.

```
460 POKEMB,PEEK(MB)AND254:POKEPR,PA:IFTR=
    0THENGOTO480                 :rem 159
470 POKE198,0:GOTO250            :rem 210
480 PRINTA$:GOSUB530:PRINT:PRINT:PRINT:PR
    INTTAB(15)"GAME OVER"         :rem 36
490 PRINT:PRINTTAB(7)"PRESS ANY KEY TO PL
    AY AGAIN":POKE198,0          :rem 146
500 GET B$:IF B$=""THEN500        :rem 79
510 POKEEN,0:POKE53277,0:PRINT"{CLR}":GOS
    UB700:SC=0:TR=10:GOTO210      :rem 49
520 REM**DISPLAY SCORE**         :rem 181
530 PRINT"{HOME}{WHT}{2 SPACES}SCORE"SC"
    {LEFT} "TAB(13)"TROOPS"TR"{LEFT} "TAB
    (23)"WS"WS"{LEFT} ";         :rem 243
540 PRINTTAB(30)"WT"WT"{LEFT}":RETURN
                                  :rem 70
550 REM**GOOD LANDING**           :rem 76
560 POKE2040,199:FORI=1TO500:NEXTI:GOSUB7
    80                           :rem 138
570 PRINTA$"{HOME}{10 SPACES}MISSION ACCO
    MPLISHED{7 SPACES}":FORI=1TO1000:NEXT
    :PRINTA$                      :rem 84
580 IF(TPAND32)=32THENSC=SC+25:GOTO610
                                  :rem 47
590 IF(TPAND64)=64THENSC=SC+50:GOTO610
                                  :rem 56
600 IF(TPAND128)=128THENSC=SC+75 :rem 143
610 POKEMB,PEEK(MB)AND254:POKEEN,254:POKE
    2040,PA:POKE198,0:GOTO250     :rem 20
620 REM**CLEAR SOUND REGISTERS** :rem 204
630 FORI=STOS+24:POKEI,0:NEXT:RETURN
                                 :rem 129
640 REM**GAME BACKGROUND**        :rem 32
650 RW=1584:CR=54272:FORI=RWTORW+39:POKEC
    R+I,5:NEXT:POKE53280,0:POKE53285,0
                                 :rem 117
660 B$="⁅7⁆{RVS}{40 SPACES}"      :rem 47
670 FORI=1TO14:PRINTB$;:NEXT:RETURN
                                  :rem 62
680 REM**TITLE SCREEN**          :rem 108
690 PRINT"{CLR}":FORA=0TO10:READL:GOSUB91
    0:NEXT                        :rem 69
700 PRINT"{12 DOWN}"TAB(14)"{CYN}(N)OVICE
    ":PRINTTAB(14)"{YEL}(I)NTERMEDIATE"
                                 :rem 187
710 PRINTTAB(14)"{GRN}(E)XPERT":POKE198,0
                                 :rem 164
```

Compose music, even if you can't read a note.



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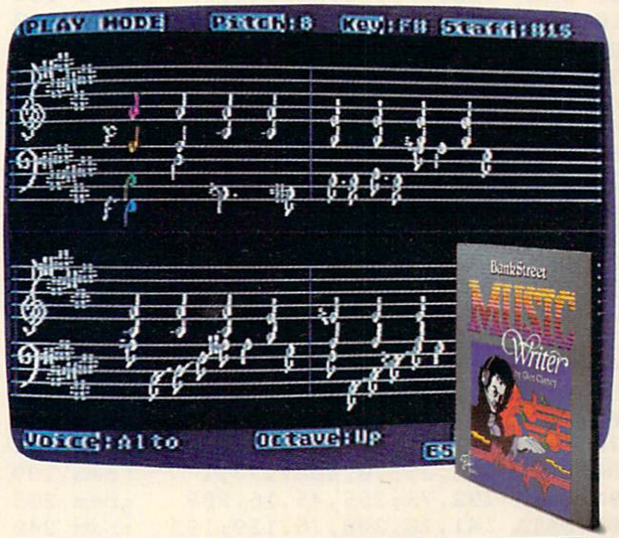

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```
720 GETB$:IFB$=""THEN720             :rem 87
730 PRINT"{CLR}"                     :rem 254
740 IFB$="N"THENPOKE53277,224:POKE2045,20
    1:POKE2046,202:POKE2047,203:RETURN
                                     :rem 130
750 IFB$="E"THENPOKE2045,201:POKE2046,202
    :POKE2047,203:RETURN             :rem 69
760 POKE2045,196:POKE2046,197:POKE2047,19
    8:RETURN                         :rem 131
770 REM**CHARGE SOUND**              :rem 93
780 POKES,97:POKES+1,8:POKES+5,0:POKES+6,
    240:POKES+24,15:POKES+4,33       :rem 28
790 FORI=1TO75:NEXT:POKES+4,32:POKES,143:
    POKES+1,10:POKES+4,33            :rem 68
800 FORI=1TO75:NEXT:POKES+4,32:POKES+1,12
    :POKES+4,33:FORI=1TO75:NEXT      :rem 30
810 POKES+4,32:POKES,195:POKES+1,16:POKES
    +4,33:FORI=1TO150:NEXT:POKES+4,32
                                     :rem 32
820 POKES,143:POKES+1,12:POKES+4,33:FORI=
    1TO75:NEXT:POKES+4,32:POKES,195
                                     :rem 199
830 POKES+1,16:POKES+4,33:FORI=1TO150:NEX
    T:POKES+4,32:RETURN              :rem 9
840 REM**SPLASH**                    :rem 243
850 POKES,0:POKES+1,64:POKES+5,17:POKES+6
    ,249:POKES+24,15                 :rem 160
860 POKES+4,129:FORI=1TO100:NEXT:POKES+4,
    128:FORI=1TO500:NEXT:POKES+1,0:RETURN
                                     :rem 197
870 REM**"POOF!" SOUND**             :rem 77
880 POKES,0:POKES+1,5:POKES+5,145:POKES+6
    ,245:POKES+24,15:POKES+4,129 :rem 127
890 FORI=1TO25:NEXT:POKES+4,128:FORI=1TO2
    00:NEXT:POKES+1,0:RETURN         :rem 184
900 REM**TITLE LETTERS**             :rem 202
910 FORI=1038+ATO1478+ASTEP40:T=I+54272:P
    OKET,1:POKET-40,6:POKEI,L        :rem 249
920 FORW=1TO10:NEXTW:NEXTI:RETURN:rem 247
930 I=49152                          :rem 39
940 READ A:IF A=256 THEN RETURN      :rem 237
950 POKE I,A:I=I+1:GOTO 940          :rem 248
960 DATA 0,0,0,0,0,0                 :rem 181
970 DATA 0,20,10,88,1,32             :rem 143
980 DATA 173,192,173,2,208,56        :rem 160
990 DATA 233,1,144,38,141,2          :rem 45
1000 DATA 208,173,16,208,41,2        :rem 132
1010 DATA 208,39,173,2,208,205       :rem 188
1020 DATA 10,192,176,31,32,196       :rem 189
1030 DATA 192,173,9,192,141,2        :rem 142
1040 DATA 208,173,16,208,9,2         :rem 92
1050 DATA 141,16,208,76,71,192       :rem 196
1060 DATA 141,2,208,173,16,208       :rem 187
1070 DATA 41,253,141,16,208,206      :rem 236
1080 DATA 3,192,208,94,173,4         :rem 100
1090 DATA 192,141,3,192,169,2        :rem 147
1100 DATA 141,0,192,14,0,192         :rem 75
1110 DATA 172,0,192,170,169,1        :rem 136
1120 DATA 10,202,208,252,141,1       :rem 169
1130 DATA 192,185,0,208,24,105       :rem 187
1140 DATA 1,153,0,208,176,36         :rem 87
1150 DATA 173,16,208,45,1,192        :rem 143
1160 DATA 240,37,185,0,208,205       :rem 189
1170 DATA 9,192,144,29,32,187        :rem 157
1180 DATA 192,153,0,208,173,1        :rem 139
1190 DATA 192,73,255,45,16,208       :rem 205
1200 DATA 141,16,208,76,159,192      :rem 248
1210 DATA 173,16,208,13,1,192        :rem 135
1220 DATA 141,16,208,173,0,192       :rem 185
1230 DATA 74,168,200,152,192,5       :rem 193
1240 DATA 208,170,76,49,234,169        :rem 2
```

```
1250 DATA 255,141,15,212,169,128  :rem 38
1260 DATA 141,18,212,173,27,212  :rem 236
1270 DATA 96,32,183,192,41,15    :rem 151
1280 DATA 153,0,208,96,32,183    :rem 148
1290 DATA 192,41,40,24,105,50    :rem 136
1300 DATA 141,3,208,96,120,169   :rem 191
1310 DATA 11,141,20,3,169,192    :rem 132
1320 DATA 141,21,3,88,96,120      :rem 90
1330 DATA 169,49,141,20,3,169,256 :rem 94
1340 REM PARA                    :rem 208
1350 DATA0,60,0,1,255,128,7,255   :rem 24
1360 DATA224,15,255,240,31,255,248,63
                                  :rem 79
1370 DATA255,252,63,255,252,59,189,220
                                 :rem 144
1380 DATA049,24,140,16,0,8,8,24   :rem 31
1390 DATA16,4,60,32,3,60,192,1   :rem 231
1400 DATA153,128,0,255,0,0,60,0    :rem 9
1410 DATA0,60,0,0,60,0,0,36       :rem 57
1420 DATA0,0,36,0,0,102,0,255    :rem 157
1430 DATA0,0,0,0,0,0,0,0         :rem 150
1440 DATA0,0,0,0,0,0,0,0         :rem 151
1450 DATA0,0,0,0,0,0,0,0         :rem 152
1460 DATA0,0,0,0,0,3,1,224         :rem 5
1470 DATA7,66,16,15,79,255,255,127
                                 :rem 204
1480 DATA255,255,64,0,0,64,0,0   :rem 231
1490 DATA0,0,0,0,0,0,0,0         :rem 156
1500 DATA0,0,0,0,0,0,0,190       :rem 254
1510 DATA0,0,0,0,0,0,0,0         :rem 149
1520 DATA0,0,0,0,0,0,0,0         :rem 150
1530 DATA0,0,0,0,0,0,0,0         :rem 151
1540 DATA0,0,0,0,0,0,0,7         :rem 159
1550 DATA128,0,15,240,0,31,252,0  :rem 61
1560 DATA31,254,0,63,255,0,255,255
                                 :rem 182
1570 DATA1,255,255,7,255,254,31,255
                                 :rem 242
1580 DATA248,255,255,192,0,0,0,0  :rem 78
1590 DATA0,6,0,0,6,0,0,15        :rem 223
1600 DATA0,0,31,128,0,22,128,0   :rem 211
1610 DATA038,192,0,38,64,0,102,64:rem 127
1620 DATA0,230,96,3,230,96,3,230  :rem 74
1630 DATA96,7,230,112,31,246,112,32
                                 :rem 224
1640 DATA30,120,127,254,252,0,6,140
                                 :rem 216
1650 DATA0,7,6,255,255,255,255,255
                                 :rem 195
1660 DATA248,255,255,224,255,255,128,0
                                 :rem 140
1670 DATA21,85,84,26,149,84,21,149
                                 :rem 203
1680 DATA84,21,149,84,26,149,84,25
                                 :rem 207
1690 DATA85,84,25,86,164,25,86,84:rem 168
1700 DATA26,150,84,21,86,164,21,85
                                 :rem 188
1710 DATA100,21,85,100,21,85,100,21
                                 :rem 205
1720 DATA86,164,21,85,84,0,0,0   :rem 237
1730 DATA0,0,0,0,0,0,0,0         :rem 153
1740 DATA0,0,0,0,0,0,0,255         :rem 6
1750 DATA5,85,80,6,149,80,6,85     :rem 4
1760 DATA80,6,85,80,6,149,80,5     :rem 0
1770 DATA149,80,5,154,144,5,153,144
                                 :rem 242
1780 DATA6,153,144,5,89,144,5,89 :rem 107
1790 DATA144,5,89,144,5,89,144,5 :rem 107
1800 DATA90,144,5,85,80,0,0,0    :rem 179
1810 DATA0,0,0,0,0,0,0,0         :rem 152
```

```
1820 DATA0,0,0,0,0,0,0,255              :rem 5
1830 DATA1,85,64,1,165,64,1,101        :rem 28
1840 DATA64,1,101,64,1,101,64,1        :rem 16
1850 DATA101,64,1,101,64,1,85,64       :rem 77
1860 DATA1,90,64,1,89,64,1,90         :rem 199
1870 DATA64,1,86,64,1,86,64,1         :rem 203
1880 DATA90,64,1,85,64,0,0,0          :rem 138
1890 DATA0,0,0,0,0,0,0,0              :rem 160
1900 DATA0,0,0,0,0,0,0,255              :rem 4
1910 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0
                                      :rem 193
1920 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0
                                      :rem 194
1930 DATA24,0,1,60,128,1,60,128        :rem 21
1940 DATA1,24,128,1,255,128,0,60       :rem 76
1950 DATA0,0,60,0,0,60,0,0              :rem 9
1960 DATA36,0,0,36,0,0,36,0            :rem 73
1970 DATA0,102,0,255                  :rem 254
1980 DATA0,0,0,0,0,0,0,0              :rem 160
1990 DATA0,0,0,0,0,0,0,0              :rem 161
2000 DATA0,0,0,0,0,0,0,0              :rem 144
2010 DATA0,0,0,0,24,0,112,24           :rem 97
2020 DATA14,204,24,51,6,24,96,3        :rem 23
2030 DATA60,192,1,189,128,112,189,14
                                       :rem 30
2040 DATA220,255,59,7,126,224,1,255
                                      :rem 231
2050 DATA128,0,255,0,0,126,0,0        :rem 213
2060 DATA5,85,80,6,165,80,5,101        :rem 33
2070 DATA80,6,165,80,6,85,80,6        :rem 250
2080 DATA85,80,6,165,80,5,85,80        :rem 49
2090 DATA5,90,144,5,89,80,5,90        :rem 252
2100 DATA144,5,85,144,5,85,144,5       :rem 85
2110 DATA90,144,5,85,80,0,0,0         :rem 174
2120 DATA0,0,0,0,0,0,0,0              :rem 147
2130 DATA0,0,0,0,0,0,0,255              :rem 0
2140 DATA1,85,64,1,169,64,1,149        :rem 39
2150 DATA64,1,169,64,1,89,64,1        :rem 248
2160 DATA89,64,1,169,64,1,85,64        :rem 53
2170 DATA1,106,64,1,102,64,1,102       :rem 60
2180 DATA64,1,102,64,1,102,64,1        :rem 16
2190 DATA106,64,1,85,64,0,0,0         :rem 179
2200 DATA0,0,0,0,0,0,0,0              :rem 146
2210 DATA0,0,0,0,0,0,0,255            :rem 255
2220 DATA0,85,0,0,105,0,0,89          :rem 120
2230 DATA0,0,89,0,0,89,0,0             :rem 23
2240 DATA89,0,0,89,0,0,85,0            :rem 85
2250 DATA0,105,0,0,101,0,0,105        :rem 197
2260 DATA0,0,89,0,0,89,0,0             :rem 26
2270 DATA105,0,0,85,0,0,0,0            :rem 60
2280 DATA0,0,0,0,0,0,0,0              :rem 154
2290 DATA0,0,0,0,0,0,0,255              :rem 7
2300 DATA0,70,80,220,210,160,160,160
                                      :rem 254
2310 DATA16,1,18,1,20,18,15,15,16,5,18
                                      :rem 102
```

Program 3: Paratrooper, VIC Loader (Part 1)

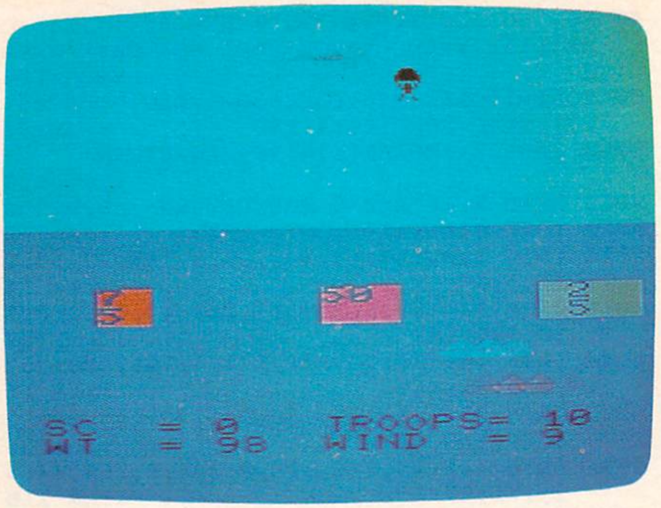
Version by Kevin Mykytyn, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

```
1J POKE52,27:POKE56,27:CLR:I=6912:rem 162
15 PRINT"{CLR}{3 DOWN}{5 RIGHT}PLEASE WAI
   T"                                 :rem 125
20 READ A:IF A=256 THEN35              :rem 58
30 CH=CH+A:POKE I,A:I=I+1:GOTO 20:rem 123
35 IFCH<>21476THENPRINT"ERROR IN DATA":EN
   D                                   :rem 76
40 S$="LO"+CHR$(34)+"P2"+CHR$(34)+",8:"+C
   HR$(131):REM CHANGE 8TO1 FOR TAPE USER
   S                                  :rem 194
50 FORI=1TOLEN(S$):POKE630+I,ASC(MID$(S$,
   I)):NEXT:POKE198,I:END              :rem 92
6000 I=6912:IFPEEK(I)=120THENRETURN
                                      :rem 133
6020 READ A:IF A=256 THENRETURN        :rem 24
6030 POKE I,A:I=I+1:GOTO 6020          :rem 78
6912 DATA 120,169,13,141,20,3,169,27,141,
     21,3,88                           :rem 55
6918 DATA 96,169,1,240,11,206,14,27,169,1
     10,141,15                        :rem 162
6924 DATA 144,76,21,235,173,4,144,208,251
     ,169,32,141                       :rem 11
6930 DATA 37,145,169,130,141,36,145,238,1
     4,27,169,59                       :rem 26
6936 DATA 141,15,144,198,0,208,9,160,44,3
     2,171,27                         :rem 118
6942 DATA 165,251,133,0,198,1,208,9,160,8
     8,32,171                         :rem 121
6948 DATA 27,165,252,133,1,198,2,208,9,16
     0,110,32                         :rem 116
6954 DATA 171,27,165,253,133,2,206,232,3,
     208,73,173                       :rem 216
6960 DATA 233,3,141,232,3,172,234,3,169,3
     2,153,0                           :rem 50
6966 DATA 30,200,153,0,30,206,234,3,16,36
     ,169,20                           :rem 48
6972 DATA 141,234,3,173,20,145,77,24,145,
     74,74,74                         :rem 126
6978 DATA 74,74,74,168,185,194,27,141,107
     ,27,141,111                       :rem 33
6984 DATA 27,141,160,27,141,166,27,76,168
     ,27,172,234                       :rem 28
6990 DATA 3,169,2,153,0,30,200,169,3,153,
     0,30                             :rem 152
6996 DATA 76,191,234,162,21,185,73,31,133
     ,254,185,72                       :rem 30
7002 DATA 31,153,73,31,136,202,208,246,16
     5,254,153,73                      :rem 48
7008 DATA 31,96,0,22,44,66,88,256:rem 101
```

Program 4: Paratrooper, VIC Main Program (Part 2)

```
0 PRINT"{CLR}{6 DOWN}{5 RIGHT}{BLK}{RVS}
  {SPACE}PARATROOPER"                 :rem 124
1 PRINT"{3 DOWN}{RED}{7 SPACES}{RVS}(N)OV
  ICE":PRINT"{2 DOWN}{RED}{7 SPACES}{RVS}
  (E)XPERT"                           :rem 252
2 B1$="{RED}7{DOWN}{LEFT}5{UP}":B2$="
  {PUR}50{DOWN}{2 LEFT}//{UP}":B3$="{WHT}
  /2/{DOWN}{3 LEFT}/5/{UP}":E$="/{DOWN}
  {LEFT}/{UP}":Q$="{HOME}{20 DOWN}"
                                      :rem 236
3 GETA$:IFA$="N"THENB1$=B1$+E$:B2$=B2$+E$
  :B3$=B3$+E$:GOTO5                   :rem 195
4 IFA$<>"E"THEN3                      :rem 141
5 PRINT"{CLR}":FORA=38400TO38905:POKEA,0:
  NEXT:FORA=38752TO38773:POKEA,5:NEXT:C=3
  0720                                :rem 243
6 FORA=38796TO38817:POKEA,2:NEXT:FORA=388
  40TO38861:POKEA,7:NEXT              :rem 180
7 FORA=1TO9:READSO(A):NEXT:DATA 175,195,2
  07,215,215,207,215,215,0             :rem 94
10 POKE36869,255:FORI=7168TO7223:READA:PO
   KEI,A:NEXT                         :rem 133
15 FORA=7552TO7632:POKEA,PEEK(A+26624):NE
   XT:FORA=7544TO7551:POKEA,255:NEXT
                                       :rem 27
```



Sailboats glide over the water while the plane passes overhead in the VIC-20 version of "Paratrooper."

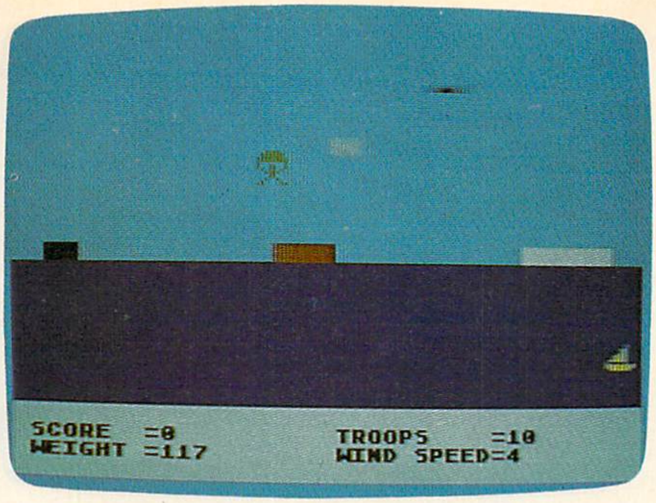
```
16 FORA=7424TO7431:POKEA,0:NEXT    :rem 142
20 DATA 60,126,126,255,255,255,129,90,90,
   60,24,24,32,36,66,0             :rem 134
25 DATA14,17,127,255,1,0,0,0,3,7,255,255,
   248,248,120,56                  :rem 181
27 DATA 0,1,3,7,8,63,31,15,128,192,224,24
   0,176,248,240,224,195,36,24,219,60,24,
   24,24                            :rem 30
30 POKE1002,20:POKE1001,10:SYS6912
                                   :rem 166
31 PRINT"{HOME}{13 DOWN}{2 RIGHT}"B1$"
   {6 RIGHT}"B2$"{5 RIGHT}"B3$     :rem 238
35 PRINT"{HOME}{16 DOWN}{GRN} DE{BLK}":PR
   INT"{DOWN}{RED} DE":TR=10:SC=0:SQ=7996
                                     :rem 9
40 WT=INT(RND(1)*125+75):WS=INT(RND(1)*9+
   1):POKE198,0:POKESQ,32:POKESQ+C,0
                                   :rem 165
42 POKESQ+22,32:POKESQ+C+22,0:FORA=38730T
   O38751:POKEA,6:NEXT             :rem 147
45 POKE251,20-WS:POKE252,18-WS:POKE0,20-W
   S:POKE1,18-WS                     :rem 7
47 PRINT"{HOME}{5 DOWN}{BLK}{22 SPACES}"
                                    :rem 52
50 PRINTQ$"{BLK}{RVS}SC{2 RIGHT}="SC"
   {LEFT}{2 SPACES}":PRINTQ$"{10 RIGHT}
   {RVS}TROOPS="TR"{LEFT} "         :rem 48
51 PRINTQ$"{DOWN}{RVS}WT{2 SPACES}="WT"
   {LEFT} ":PRINTQ$"{RVS}{DOWN}{10 RIGHT}
   WIND{2 RIGHT}="WS"{LEFT} "       :rem 60
52 IFTR=0THEN300                   :rem 203
55 GETA$:IFA$=""THEN55             :rem 247
60 SX=PEEK(1002):SY=PEEK(7019)/22+1:DX=WS
   /20:DY=WT/400                   :rem 176
70 POKESQ,32:POKESQ+22,32:SP=SX+7680+INT(
   SY)*22                           :rem 94
72 CL=PEEK(SP+30742)AND 15:CO=PEEK(SP+307
   20)AND 15:IF CL<>0 OR CO<>0 THEN 90
                                   :rem 171
75 POKESP,0:POKESP+22,1            :rem 146
80 SX=SX+DX:SY=SY+DY:SQ=SP:FORA=1TO100:NE
   XT                              :rem 148
85 GOTO70                           :rem 13
90 IFCL=2ANDSY<13THENSC=SC+75:GOSUB200:GO
   TO40                            :rem 103
100 IFCL=1ANDSY<13THENSC=SC+25:GOSUB200:G
    OTO40                          :rem 137
110 IFCL=4ANDSY<13THENSC=SC+50:GOSUB200:G
    OTO40                          :rem 139
190 PRINT"{HOME}{5 DOWN}{BLK}{2 SPACES}
    {RVS}PARATROOPER FAILED":TR=TR-1:POKE
    SQ,6:POKESQ+C,1:FORV=15TO0STEP-1
                                    :rem 88
195 POKE36877,210:POKE36878,V:FORTD=1TO50
    :NEXT:NEXT:POKE36877,0:SC=SC-10:GOTO4
    0                              :rem 148
200 POKESQ,0:POKESQ+22,1:PRINT"{HOME}
    {5 DOWN}{BLK} {RVS}MISSION ACCOMPLISH
    ED"                             :rem 93
210 POKE36878,15:FORA=1TO9:POKE36876,SO(A
    ):FORB=1TO130:NEXT:NEXT:RETURN
                                   :rem 251
300 PRINT"{HOME}{5 DOWN}{BLK}{7 SPACES}
    {RVS}GAME OVER":PRINT"{DOWN}
    {5 SPACES}{RVS}ANOTHER GAME?" :rem 92
310 POKE37166,127:POKE788,191:POKE789,234
    :POKE37166,192                 :rem 117
320 GETA$:IFA$="Y"THENRUN            :rem 6
330 IFA$<>"N"THEN320                :rem 90
```

Program 5: Paratrooper For Atari

Version by Kevin Mykytyn, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
BD 0  DIM SND(7,1):FOR A=1 TO 7:REA
      D B,C:SND(A,0)=B:SND(A,1)=C:N
      EXT A:DATA 121,1,96,1,81,1,60
      ,2,81,1,60,2,0,1
JH 1  GRAPHICS 17:POSITION 4,8:PRIN
      T #6;"paratrooper":POSITION 5
      ,10:PRINT #6;"<N>OVICE":POSIT
      ION 5,12
DN 2  PRINT #6;"<E>XPERT":POKE 764,
      255:DIM A$(3),B$(3),C$(3)
JM 3  IF PEEK(764)=42 THEN A$="z":B
      $="ZZ":C$="YY":GOTO 6
HG 4  IF PEEK(764)=35 THEN A$="y":B
      $="[illegible]":C$="YYY":GOTO 6
KB 5  GOTO 3
HJ 6  POKE 54279,56:GRAPHICS 1:SETC
      OLOR 4,9,10:SETCOLOR 0,8,3:SE
      TCOLOR 2,0,15:SETCOLOR 1,0,0
EN 10 POKE 559,62:POKE 53277,3:POK
      E 704,200:POKE 705,0:POKE 70
      6,13:POKE 707,44:POKE 623,1
OP 11 T=0:IF PEEK(13824)<>169 THEN
       FOR A=13824 TO 14147:READ B
      :T=T+B:POKE A,B:NEXT A:IF T<
      >39469 THEN PRINT "ERROR":EN
      D
PO 15 IF PEEK(14345)<>24 THEN FOR
      A=14336 TO 14848:POKE A,PEEK
      (A+43008):NEXT A
FA 16 POKE 756,56:FOR A=14790 TO 1
      4799:POKE A,255:NEXT A
GC 20 FOR A=14800 TO 14808:POKE A,
      15:NEXT A
BG 30 FOR A=0 TO 19:FOR B=12 TO 23
      :POSITION A,B:PRINT #6;"Y";:
      NEXT B:NEXT A
KC 35 POSITION 1,11:PRINT #6;A$;"
      {6 SPACES}";B$;"{6 SPACES}";
      C$:A=USR(13824)
```



Atari "Paratrooper" uses player/missile graphics, a display list interrupt, and machine language to smooth out the action.

```
EK 40  TR=10:SC=0:FOR A=14326 TO 14
       328:POKE A,100:NEXT A
MF 50  POKE 14320,0:FOR TD=1 TO 100
       0:NEXT TD:POSITION 0,1:PRINT
        #6;"{20 SPACES}":POKE 752,1
GG 52  WS=INT(RND(1)*9)+1:WT=INT(RN
       D(1)*125)+75:BS=WS-1:CS=WS+1
       :POKE 14330,15-CS:POKE 14331
       ,15-CS
KF 55  POKE 14332,15-BS:POKE 14333,
       15-BS
JO 60  POKE 656,1:POKE 657,1:PRINT
       "SCORE  =";SC;"  ":POKE 656,
       1:POKE 657,20:PRINT "TROOPS
       {4 SPACES}=";TR;" "
FG 61  IF TR=0 THEN POSITION 5,5:PR
       INT #6;"GAME OVER":POSITION
       4,7:POKE 764,255:GOTO 300
BF 70  POKE 656,2:POKE 657,1:PRINT
       "WEIGHT =";WT;" ":POKE 656,2
       :POKE 657,20:PRINT "WIND SPE
       ED=";WS:POKE 764,255
HO 80  IF PEEK(764)=255 THEN 80
BK 90  POKE 14145,0:POKE 704,200:EN
       =(RND(1)*50)+120:START=PEEK(
       14321):INC=WT/300:C=WS/10:B=
       PEEK(14326)
JK 100  FOR A=START TO EN STEP INC:
        POKE 53278,0:POKE 14320,A:P
        OKE 14325,B:B=B+C:IF B>200
        THEN B=40
MI 110  P=PEEK(53252):ON P GOTO 210
        ,220,210,230,210,210,210,24
        0
DF 210  NEXT A:SC=SC-10:TR=TR-1:POS
        ITION 1,1:PRINT #6;"PARATRO
        OPER FAILED"
NA 215  POKE 14145,30:POKE 704,15:F
        OR A=15 TO 0 STEP -1:SOUND
        0,10,8,A:FOR B=1 TO 10:NEXT
         B:NEXT A:GOTO 50
KC 220  SC=SC+75:GOTO 245
JO 230  SC=SC+25:GOTO 245
IP 240  SC=SC+50
MK 245  POSITION 0,1:PRINT #6;"MISS
        ION ACCOMPLISHED"
DM 250  FOR A=1 TO 7:SOUND 0,SND(A,
        0),10,15:FOR B=1 TO 50*SND(
        A,1):NEXT B:NEXT A:GOTO 50
LN 300  PRINT #6;"HIT RETURN"
NG 301  IF PEEK(764)=255 THEN 301
CI 310  FOR A=704 TO 707:POKE A,0:N
        EXT A:POKE 623,4:RUN
JF 13824 DATA 169,0,160,0,153,0,60
         ,153,0,61,153,0,62,153,0,
         63,136,208
BF 13842 DATA 241,160,11,185,41,55
         ,153,74,62,185,53,55,153,
         163,63,136,16,241
CN 13860 DATA 160,47,162,54,169,7,
         32,92,228,104,96,216,206,
         244,55,208,38,169
HP 13878 DATA 3,141,244,55,206,246
         ,55,173,246,55,201,48,208
         ,23,169,200,141,246
LK 13896 DATA 55,173,10,210,16,8,1
         69,80,141,241,55,76,91,54
         ,169,50,141,241
IC 13914 DATA 55,206,250,55,208,21
         ,173,251,55,141,250,55,23
         8,247,55,173,247,55
HC 13932 DATA 201,200,208,5,169,48
         ,141,247,55,206,252,55,20
         8,21,173,253,55,141
DL 13950 DATA 252,55,238,248,55,17
         3
PK 13956 DATA 248,55,201,200,208,5
EF 13962 DATA 169,48,141,248,55,16
         9
AK 13968 DATA 0,141,249,55,173,249
AA 13974 DATA 55,168,24,105,60,133
CL 13980 DATA 204,169,0,133,203,18
         5
AL 13986 DATA 242,55,168,169,0,162
CA 13992 DATA 15,145,203,200,202,1
         6
HM 13998 DATA 250,173,249,55,168,1
         85
OP 14004 DATA 65,55,24,105,252,141
LL 14010 DATA 205,54,169,0,105,54
CH 14016 DATA 141,206,54,185,240,5
         5
PC 14022 DATA 153,242,55,168,162,0
JA 14028 DATA 189,255,255,145,203,
         200
FJ 14034 DATA 232,224,15,208,245,2
         38
CP 14040 DATA 249,55,173,249,55,20
         1
AB 14046 DATA 2,144,179,173,245,55
PD 14052 DATA 141,0,208,173,246,55
PL 14058 DATA 141,1,208,173,247,55
PK 14064 DATA 141,2,208,173,248,55
MP 14070 DATA 141,3,208,76,98,228
GE 14076 DATA 60,126,126,255,255,1
         29
MC 14082 DATA 153,153,90,60,24,24
KO 14088 DATA 36,66,195,1,99,255
```

```
LJ 14094 DATA 255,0,0,0,0,0,0,0,0,
         0,0,0,129,66,36,153,90,64
         ,0,0,0,0,0,0
FD 14118 DATA 0,0,0,102,247,239
CE 14124 DATA 255,126,255,239,102,
         0
EK 14130 DATA 0,0,0,4,4,12
LL 14136 DATA 12,28,60,60,124,132
IJ 14142 DATA 255,255,126,0,15,0
```

Program 6: Paratrooper For Apple

Version by Tim Victor, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

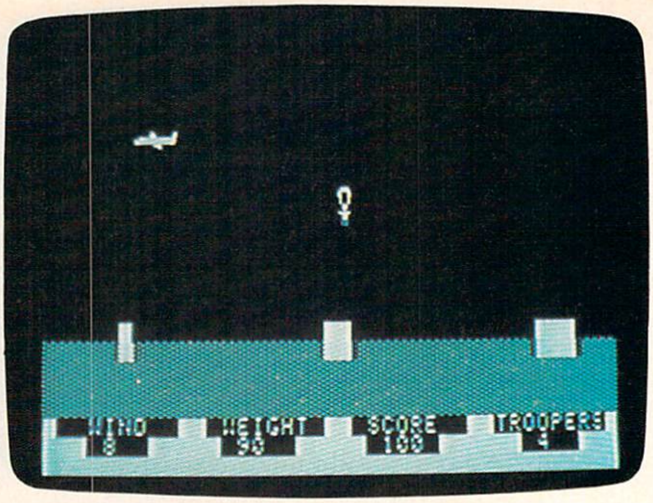
```
100  GOTO 150
110  VTAB AL: HTAB AH: PRINT SK$;
120 AH = AH - 1: IF AH = 0 THEN AH = 38

130  VTAB AL: HTAB AH: PRINT PL$;
140  RETURN
150 SK$ = "    ":WA$ = "#$%&":PL$ = "'()
    ":TR$(0) = "*":TR$(1) = "+"
160 P1$ = ",":P2$ = "-":S1$ = ".":S2$ =
    "/"
170 KB = 49152
180 X = 0: FOR I = 141 * 256 + 24 TO I +
     103: READ A:X = X + A: POKE I,A: NEXT

190  FOR I = 141 * 256 TO I + 7: POKE I
     ,0: NEXT
200  FOR I = 768 TO I + 84: READ A:X =
     X + A: POKE I,A: NEXT : IF X < >
     23201 THEN  PRINT "ERROR IN DATA S
     TATEMENTS.": STOP
210  POKE 6,0: POKE 7,141
220  POKE 54,0: POKE 55,3: CALL 1002
230  HOME : HGR
240  FOR I = 17 TO 20: VTAB I: HTAB 1: FOR
      J = 1 TO 39 STEP 4: PRINT WA$;
250  NEXT : NEXT
260  FOR I = 16 TO 17: VTAB I
270  INVERSE : HTAB 6: PRINT " ";: HTAB
     20: PRINT "  ";: HTAB 35: PRINT "
      ";: NEXT
280  FOR I = 21 TO 23: HTAB 1: VTAB I: FOR
      J = 0 TO 39: PRINT " ";: NEXT : NEXT

290  NORMAL : VTAB 21: HTAB 2: PRINT "
      WIND  ";: HTAB 12: PRINT " WEIGHT
      ";: HTAB 22: PRINT " SCORE  ";: HTAB
      32: PRINT "TROOPERS";
300  GOSUB 730
310 AL =  RND (1) * 7 + 1:AH = 39:WD =
      INT (1 + 10 *  RND (1)):WG =  INT
     (75 + 175 *  RND (1))
320 PD = WD / 15:PG = WG / 250
330  VTAB 22: HTAB 4: PRINT "    ";: HTAB
     13: PRINT "     ";
340  HTAB 23: PRINT "      ";: HTAB 34: PRINT
     "   ";
350  VTAB 22: HTAB 5: PRINT WD;:: HTAB
     14: PRINT WG;
360  HTAB 24: PRINT SC;: HTAB 35: PRINT
     TR;
370  POKE 49168,0
380  GOSUB 110: FOR I = 1 TO DF: NEXT :
      IF  PEEK (KB) > 128 THEN  POKE 49
     168,0: GOTO 400
390  GOTO 380
400 PY = AL + 1:PX = AH + 1
410  GOSUB 110: FOR I = PY TO PY + 1: VTAB
     I: HTAB PX: PRINT TR$(I - PY);: NEXT

420  FOR I = 1 TO 80: NEXT
```



The landing pads are always the same size in Apple "Paratrooper," but the plane moves faster in the harder level.

```
430  FOR I = PY TO PY + 1: VTAB I: HTAB
     PX: PRINT " ";: NEXT
440 PX = PX + PD: IF PX > 41 THEN PX =
    PX - 40
450 PY = PY + PG: IF PY > 14 THEN  GOSUB
     480: IF PY = 0 THEN 310
460  IF PY > 16 THEN  GOSUB 620: GOTO 3
     10
470  GOTO 410
480  IF PX < 6 THEN  RETURN
490  IF PX < 7 THEN SC = SC + 75: GOTO
     550
500  IF PX < 20 THEN  RETURN
510  IF PX < 22 THEN SC = SC + 50: GOTO
     550
520  IF PX < 35 THEN  RETURN
530  IF PX < 38 THEN SC = SC + 25: GOTO
     550
540  RETURN
550  FOR I = 14 TO 15: VTAB I: HTAB PX:
      PRINT TR$(I - 14);: NEXT
560  VTAB AL: HTAB AH: PRINT SK$;
570  FOR I = 1 TO 200: NEXT : VTAB 14: HTAB
     PX: PRINT " ";: HTAB PX: PRINT P1$
     ;
580  FOR I = 1 TO 200: NEXT : HTAB PX: PRINT
     " ";: HTAB PX: PRINT P2$;
590  VTAB 24: HTAB 2: PRINT "CONGRATULA
     TIONS! MISSION ACCOMPLISHED";: FOR
     I = 1 TO 1200: NEXT : HTAB 1: CALL
      - 868
600  FOR I = 14 TO 15: VTAB I: HTAB PX:
      PRINT " ";: NEXT
610 PY = 0: RETURN
620  VTAB AL: HTAB AH: PRINT SK$;
630  FOR I = 15 TO 16: VTAB I: HTAB PX:
      PRINT " ";: NEXT
640  VTAB 16: HTAB PX: PRINT S1$;: FOR
     I = 1 TO 200: NEXT : VTAB 16: HTAB
     PX: PRINT " ";
650  VTAB 16: HTAB PX: PRINT S2$;: VTAB
     24: HTAB 2: PRINT "SPLASH! PARATRO
     OPER MISSED THE TARGET";
660  FOR I = 1 TO 1200: NEXT : HTAB 1: CALL
      - 868: VTAB 16: HTAB PX: PRINT "
     ";
670 SC = SC - 10: IF SC < 0 THEN SC = 0

680 TR = TR - 1: IF TR > 0 THEN  RETURN
```

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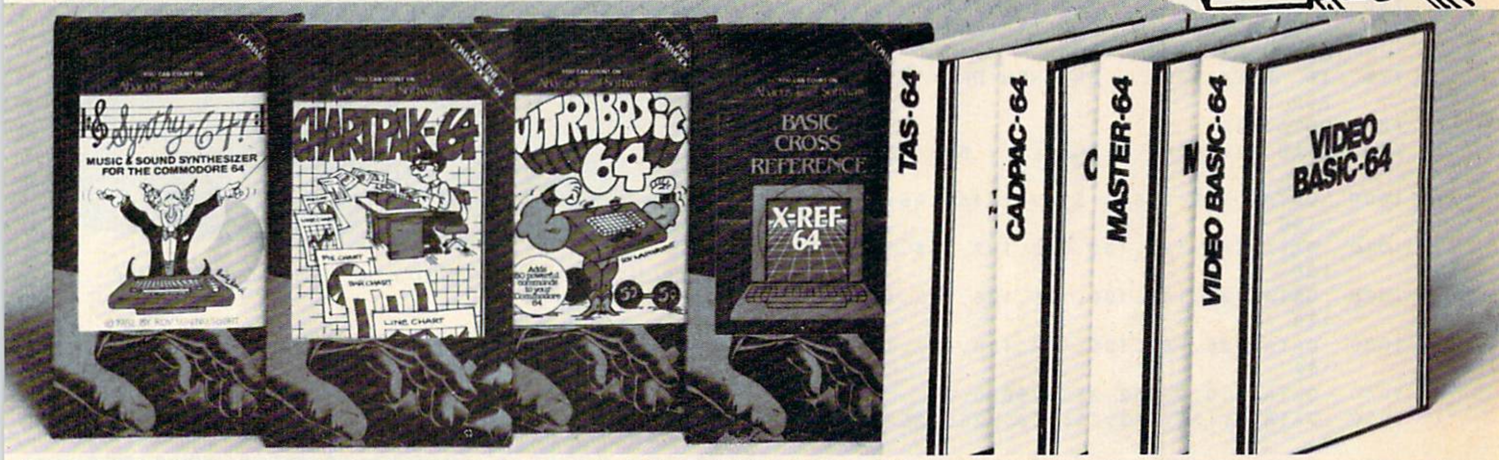

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```
690  VTAB 22: HTAB 24: PRINT SC;: HTAB
     35: PRINT TR;
700  VTAB 24: HTAB 2: PRINT "GAME OVER-
      PRESS ANY KEY TO PLAY AGAIN";
710  IF  PEEK (KB) < 128 THEN 710
720  POKE 49168,0: VTAB 24: HTAB 1: CALL
      - 868
730 SC = 0:TR = 10
740  VTAB 24: HTAB 2: PRINT "SELECT DIF
     FICULTY: (1) EASY, (2) HARD";
750  IF  PEEK (KB) < 128 THEN 750
760  POKE 49168,0: IF  PEEK (KB) = 49 THEN
     DF = 150: GOTO 790
770  IF  PEEK (KB) = 50 THEN DF = 30: GOTO
     790
780  GOTO 750
790  VTAB 24: HTAB 1: CALL  - 868: RETURN

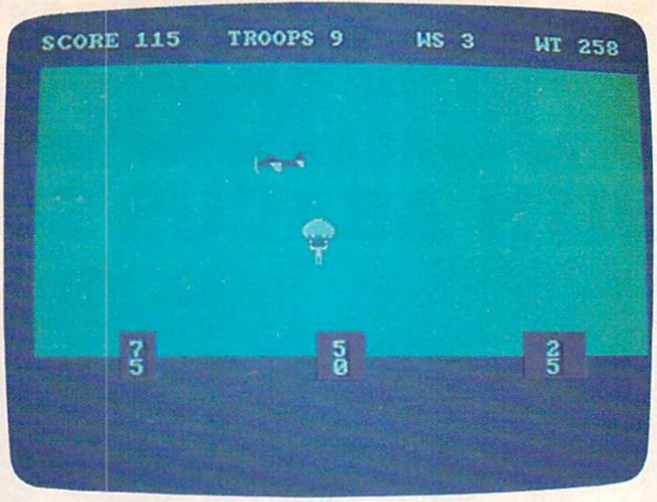
1000  DATA  145,196,145,196,145,196,145
     ,196
1010  DATA 162,136,162,136,162,136,162,
     136
1020  DATA 196,145,196,145,196,145,196,
     145
1030  DATA 136,162,136,162,136,162,136,
     162
1040  DATA 0,0,0,252,255,255,0,0
1050  DATA 0,134,143,255,255,255,252,22
     4
1060  DATA 192,224,240,255,255,191,0,0
1070  DATA 190,255,227,227,162,162,162,
     156
1080  DATA 156,136,255,156,156,148,148,
     148
1090  DATA   0,0,190,255,227,227,162,15
     6
1100  DATA   0,0,0,0,0,0,0,156
1110  DATA 190,255,227,227,156,156,136,
     255
1120  DATA   0,0,0,0,190,255,227,227
1130  DATA 133,69,134,70,132,71,166,7
1140  DATA 10,10,176,4,16,62,48,4
1150  DATA 16,1,232,232,10,134,27,24
1160  DATA 101,6,133,26,144,2,230,27
1170  DATA 165,40,133,8,165,41,41,3
1180  DATA 5,230,133,9,162,8,160,0
1190  DATA 177,26,36,50,48,2,73,127
1200  DATA 164,36,145,8,230,26,208,2
1210  DATA 230,27,165,9,24,105,4,133
1220  DATA 9,202,208,226,165,69,166,70
1230  DATA 164,71,76,240,253
```

Program 7: Paratrooper For IBM PC/PCjr

Version by Patrick Parrish, Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
LK 100 KEY OFF
DB 110 DEF FNSZ(X,Y)=(4+INT((X+7)/8)*Y
       )/2
CH 120 GOSUB 890 ' title screen 1
HF 130 GOSUB 250 ' title screen 2
BA 140 GOSUB 230 ' initialize variable
       s
GG 150 GOSUB 330 ' set up background
OA 160 GOSUB 420 ' start game
GD 170 LOCATE 10,15:PRINT "GAME OVER"
KC 180 LOCATE 12,7:PRINT "PRESS ANY KE
       Y TO PLAY AGAIN":DEF SEG=0:POKE
        1050,PEEK(1052)
MH 190 A$=INKEY$:IF A$=""THEN 190
MM 200 FLAG=0
CA 210 GOTO 130
```



A chutist plunges downward in "Paratrooper" for the IBM PC/PCjr.

```
GD 220 ' initialize variables
EG 230 SCORE=0:TROOPS=10:WT=0:WS=0:RET
       URN
HB 240 ' input level routine
JC 250 CLS:SCREEN 1:DEF SEG=0:POKE 105
       0,PEEK(1052)
OK 260 LOCATE 10,15:PRINT "LEVEL :"
EO 270 LOCATE 12,15:PRINT "(N)ovice"
PH 280 LOCATE 14,15:PRINT "(E)xpert"
PE 290 A$=INKEY$:IF A$=""THEN 290
OP 300 CLS
MP 310 RETURN
HB 320 ' set up background
AF 330 CLS
NI 340 COLOR 9,1:LINE(0,0)-(320,150),1
       ,BF
NB 350 GOSUB 800 ' display score
PD 360 IF A$="N" OR A$="n" THEN 370 EL
       SE 380
OP 370 LINE(43,140)-(60,160),2,BF:LINE
       (143,140)-(168,160),2,BF:LINE(2
       51,140)-(284,160),2,BF:A=284:B=
       170:C=60:D=249:E=139:F=41:GOTO
       390
KI 380 LINE(46,140)-(57,160),2,BF:LINE
       (146,140)-(165,160),2,BF:LINE(2
       54,140)-(281,160),2,BF:A=281:B=
       165:C=57:D=252:E=144:F=44
JI 390 LOCATE 19,7:PRINT "7":LOCATE 20
       ,7:PRINT "5":LOCATE 19,20:PRINT
        "5":LOCATE 20,20:PRINT "0":LOC
       ATE 19,34:PRINT "2":LOCATE 20,3
       4:PRINT "5"
MO 400 RETURN
FO 410 ' game routine
BJ 420 PLX=1
OF 430 DEF SEG=&H40 : RANDOMIZE PEEK(&
       H6D)
IA 440 GOSUB 800
PH 450 PLY=INT(RND(1)*30)+40:NY=PLY
LE 460 GOSUB 840
DF 470 IF JUMP=1 THEN 490
```

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```
KK 480 IF INKEY$<>"" THEN JUMP=1:PX=PL
       X+5:PY=PLY+10:PUT (PX,PY),TROOP
       %
JG 490 IF JUMP=1 THEN GOSUB 540
OI 500 IF TROOPS=0 THEN FLAG=1:GOTO 52
       0
GC 510 GOTO 460
MD 520 RETURN
HG 530 ' jump routine
AC 540 PUT(PX,PY),TROOP%:PX=PX+DX:PY=P
       Y+DY:IF PX>299 THEN PX=1
HK 550 PUT(PX,PY),TROOP%
OL 560 T=INT(PY):IF T<=119 AND T>=116
       THEN 600
EE 570 IF PY>=BOT THEN 730
HP 580 RETURN
OE 590 ' hit?
EN 600 L=PX+9
EN 610 IF L<=A AND L>=D THEN PAD=1:GOT
       O 650
IN 620 IF L<=B AND L>=E THEN PAD=2:GOT
       O 650
MM 630 IF L<=C AND L>=F THEN PAD=3:GOT
       O 650
MI 640 RETURN
BH 650 PUT(PX,PY),TROOP%:PUT(PX,PY),LA
       ND%
EI 660 SCORE=SCORE+PAD*25
IE 670 LOCATE 1:PRINT "             MISSI
       ON SUCCESSFUL!                 "
BD 680 FOR W=1 TO 100:GOSUB 830:NEXT W
MK 690 PUT(PX,PY),LAND%:NY=INT(RND(1)*
       30)+40
JB 700 JUMP=0:GOSUB 800
FN 710 DEF SEG=0:POKE 1050,PEEK(1052):
       RETURN
OG 720 ' miss !
PM 730 PUT(PX,PY),TROOP%:PUT(PX,PY),SP
       LASH%
OF 740 LOCATE 1:PRINT "            TROOPE
       R MISSED TARGET                "
BO 750 FOR W=1 TO 100:GOSUB 830:NEXT W
DM 760 TROOPS=TROOPS-1:SCORE=SCORE-10:
       JUMP=0:GOSUB 800
DP 770 PUT(PX,PY),SPLASH%:NY=INT(RND(1
       )*30)+40
GL 780 DEF SEG=0:POKE 1050,PEEK(1052):
       RETURN
JP 790 ' display score
GF 800 WS=INT(RND(1)*11):DX=WS/6:WT=IN
       T(RND(1)*225)+75:DY=WT/150:BOT=
       INT(RND(1)*15)+160
MI 810 LOCATE 1:PRINT "SCORE";TAB(6);S
       CORE;TAB(13);"TROOPS";TAB(19);T
       ROOPS;TAB(26);"WS";TAB(28);WS;T
       AB(34);"WT";TAB(36);WT;TAB(40);
       " "
MG 820 RETURN
FB 830 ' move plane routine
IB 840 PLX=PLX-1
AA 850 IF PLX=0 THEN LINE(1,PLY)-(28,P
       LY+10),1,BF:PLX=280:PLY=NY
DN 860 PUT(PLX,PLY),PLANE%,PSET
MA 870 RETURN
IJ 880 ' read sprite data and display
       title page
FL 890 READ X,Y:N=FNSZ(X,Y)
IB 900 DIM PLANE%(N)
HE 910 PLANE%(0)=X:PLANE%(1)=Y
PC 920 FOR I=2 TO N:READ PLANE%(I):NEX
       T I
EA 930 READ X,Y:N=FNSZ(X,Y)
CO 940 DIM TROOP%(N)
DG 950 TROOP%(0)=X:TROOP%(1)=Y
IH 960 FOR I=2 TO N:READ TROOP%(I):NEX
       T I
FI 970 READ X,Y:N=FNSZ(X,Y)
NB 980 DIM LAND%(N)
EK 990 LAND%(0)=X:LAND%(1)=Y
OB 1000 FOR I=2 TO N:READ LAND%(I):NEX
        T I
GC 1010 READ X,Y:N=FNSZ(X,Y)
HC 1020 DIM SPLASH%(N)
FN 1030 SPLASH%(0)=X:SPLASH%(1)=Y
AF 1040 FOR I=2 TO N:READ SPLASH%(I):N
        EXT I
DK 1050 TEMP$="E8G16G3L16FEDL5EFF#G":T
        EMP1$="A8>C16C3L16DC<AG2":TEMP
        3$="B8>D16D3L16C<BA>D2":T$=TEM
        P$+TEMP1$:S$=TEMP$+TEMP3$
MN 1060 CLS:SCREEN 1:COLOR 9,1
MC 1070 PLAY "MB T90 O2 L8;XT$;"
FJ 1080 A$="P":L=11:X=75:GOSUB 1220
LK 1090 A$="A":L=13:X=91:GOSUB 1220
OP 1100 A$="R":L=15:X=107:GOSUB 1220
FK 1110 A$="A":L=17:X=123:GOSUB 1220
ME 1120 A$="T":L=19:X=139:GOSUB 1220
KO 1130 PLAY "MB T90 O2 L8;XS$;"
BH 1140 A$="R":L=21:X=155:GOSUB 1220
PO 1150 A$="O":L=23:X=171:GOSUB 1220
LK 1160 A$="O":L=25:X=187:GOSUB 1220
PL 1170 A$="P":L=27:X=203:GOSUB 1220
EJ 1180 A$="E":L=29:X=219:GOSUB 1220
CP 1190 A$="R":L=31:X=235:GOSUB 1220
ED 1200 FOR I=1 TO 500:NEXT I
IC 1210 RETURN
BM 1220 FOR I=1 TO 64:PUT(X,I),TROOP%,
        PSET:NEXT I:PUT(X,64),TROOP%:P
        UT(X,64),LAND%:LOCATE 9,L:PRIN
        T A$:RETURN
OE 1230 ' plane
OM 1240 DATA &H38,&hB,&h5555,&h5555,&h
        5555,&h5555,&h5555,&h5555
NB 1250 DATA &HA555,&H5555,&H5555,&H56
        55,&HD5A5,&HA956,&H5555,&HA55A
DP 1260 DATA &H5AD5,&H550A,&h5A55,&hD5
        A5,&h2A8,&hAAAA,&HF5AF,&HAAEA
CK 1270 DATA &HFAFF,&HABAA,&HEAF5,&HBF
        AA,&HAAFA,&HF5AA,&H55D5,&HF55F
EL 1280 DATA &H5555,&HD555,&H5755,&H55
        F5,&H5555,&H55D5,&H5555,&H5555
NB 1290 DATA &H55
BL 1300 ' TROOPER
EE 1310 DATA &H2A,&H17,&H0,&H0,&H0,&H0
        ,&H80AA,&H0
EE 1320 DATA &HA00,&HA8AA,&H0,&HAA00,&
        HAAAA,&H80,&HAA02,&HAAAA
PJ 1330 DATA &HA0,&HAA0A,&HAAAA,&HA8,&
        HAA0A,&HAAAA,&HA8,&HAA0A
IO 1340 DATA &HAAAA,&HA8,&H8A02,&HA888
        ,&HA0,&H8200,&H2000,&H80
OP 1350 DATA &hC300,&H3000,&HC0,&H3B00
```

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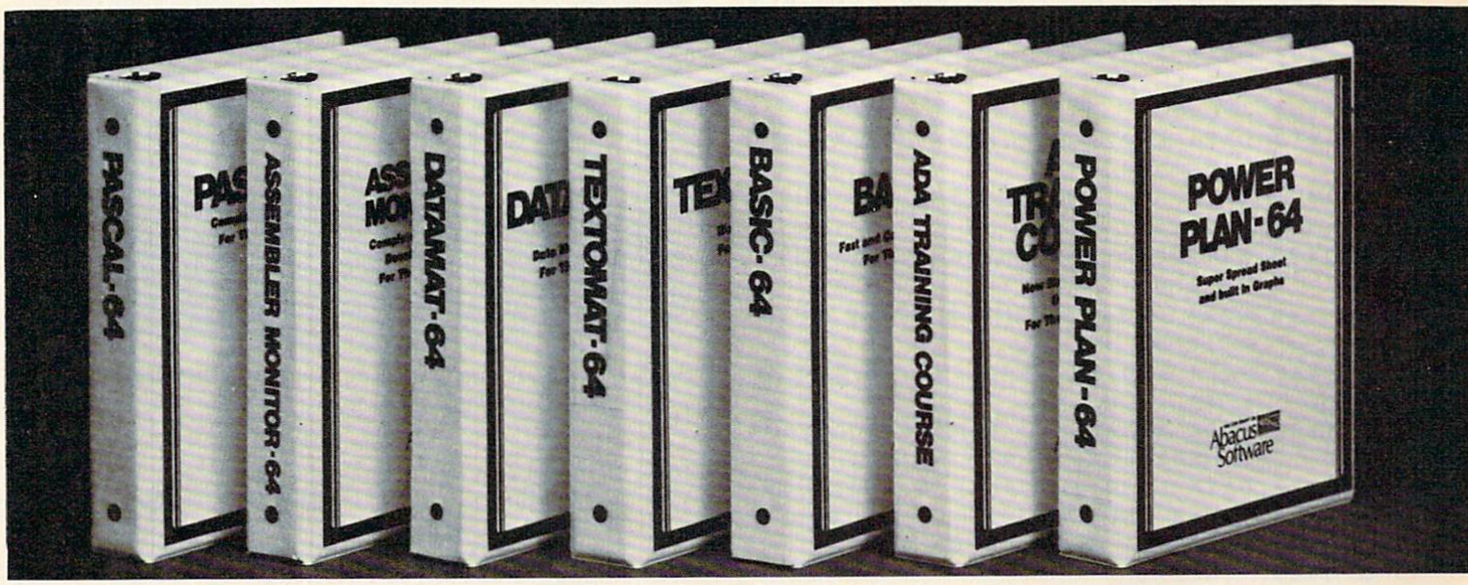

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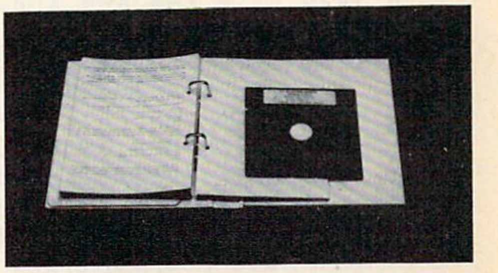

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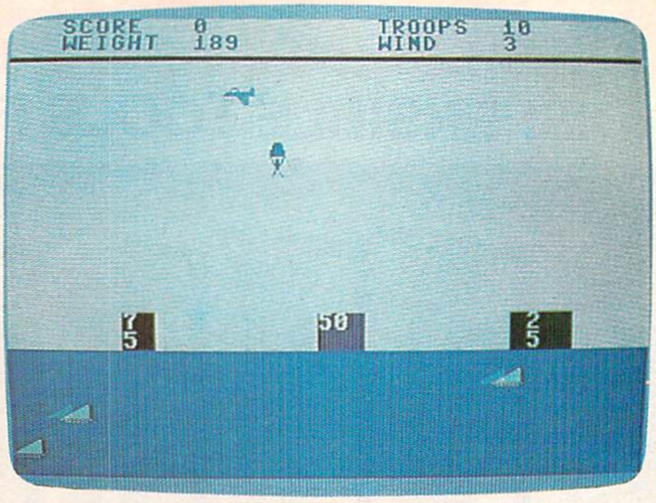
```
        ,&H3B3F,&H0,&HF00,&H3C3F
NL 1360 DATA &H0,&HB00,&H380C,&H0,&HA0
        0,&HA8AA,&H0,&H0
MB 1370 DATA &H2A,&H0,&H0,&H2A,&H0,&H0
        ,&H2A,&H0
BH 1380 DATA &H0,&H22,&H0,&H0,&H22,&H0
        ,&H0,&H22
JK 1390 DATA &H0,&H0,&H22,&H0,&H0,&H0,
        &H0,&H0
PE 1400 ' LAND
FL 1410 DATA &H22,&H17,&H0,&H0,&H0,&H0
        ,&H0,&H0
BP 1420 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
BC 1430 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
BF 1440 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
BI 1450 DATA &H0,&H0,&H0,&HC00F,&H0,&H
        8F00,&HC8,&H0
QP 1460 DATA &H883,&H0,&HAA00,&HA8,&H0
        ,&H800A,&H0,&HA00
JD 1470 DATA &H80,&H0,&H800A,&H0,&H800
        ,&H80,&H0,&H8008
LL 1480 DATA &H0,&H800,&H80,&H0
CF 1490 ' SPLASH
EL 1500 DATA &H30,&H17,&H0,&H0,&H0,&H0
        ,&H0,&H0
BO 1510 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
BB 1520 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
BE 1530 DATA &H0,&H0,&H0,&H0,&H0,&H0,&
        H0,&H0
PA 1540 DATA &H0,&H0,&H0,&H0,&H5555,&H
        0,&H5500,&H5555
AF 1550 DATA &H55,&H5505,&HFFFF,&H5055
        ,&HFF15,&HFFFF,&H54FF,&HFF17
ID 1560 DATA &HFFFF,&HD4FF,&HFF55,&HFF
        FF,&H55FF,&H5515,&HFD7F,&H5455
CN 1570 DATA &H5505,&H5555,&H5055,&H55
        00,&H5555,&H55,&H300,&H57D5
PE 1580 DATA &HC0,&H300,&HFFFF,&HC0,&H
        0,&HFC3F,&H0,&H0
```

Program 8: Paratrooper For Plus/4 & Commodore 16

Version by Patrick Parrish, Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 POKE55,0:POKE 56,60:CLR:GOSUB500:C=-10
   24:SQ=3072:SYS1002
20 RESTORE 40:FORA=15632TO15687:READB:POK
   EA,B:NEXT
30 FORA=15360TO15367:POKEA,255:NEXT
40 DATA 60,126,126,255,255,255,129,90,90,
   60,24,24,32,36,66,0
50 DATA14,17,127,255,1,0,0,0,3,7,255,255,
   248,248,120,56
60 DATA255,255,255,254,250,234,085,213
70 DATA251,235,171,171,171,171,85,87,195,
   36,24,219,60,24,24,24
80 PRINT"{CLR}{8 DOWN}{RED}"SPC(14)"PARAT
   ROOPER"
90 PRINT"{2 DOWN}{BLU}"SPC(15)"(N)OVICE"
100 PRINT"{DOWN}"SPC(15)"(E)XPERT"
```



"Paratrooper" is one of COMPUTE!'s *first programs for the new Commodore Plus/4 and 16.*

```
110 PRINT"{DOWN}"SPC(16)"(Q)UIT"
120 B1$="{RED}A{DOWN}{LEFT}?{UP}":B2$="
    {PUR}?:{DOWN}{2 LEFT}@@{UP}":B3$="
    {GRN}@<@{DOWN}{3 LEFT}@?@{UP}":E$="@
    {DOWN}{LEFT}@{UP}"
130 GETKEY A$:IFA$="N"THENB1$=B1$+E$:B2$=
    B2$+E$:B3$=B3$+E$:GOTO 160
140 IFA$="Q"THENPRINT"{CLR}":END
150 IFA$<>"E"THEN130
160 PRINT"{CLR}"
170 POKE 65298,PEEK(65298)AND251
180 POKE 65299,PEEK(65299)AND3OR4*15
190 PRINT"{HOME}{16 DOWN}{7 RIGHT}"B1$"
    {10 RIGHT}"B2$"{9 RIGHT}"B3$
200 FORA=3152TO3191:POKEA,68:POKEA+C,0:NE
    XT
210 FORA=3792TO4071:POKEA,0:NEXT
220 PRINT"{2 DOWN}{CYN}&'{2 DOWN}{BLK}&'
    {2 DOWN}{RED}&'"
230 POKE65287,PEEK(65287)OR16:FORA=3792+C
    TO4071+C:POKEA,78:NEXT
240 POKE1041,38:SYS819:TR=10:SC=0
250 WT=INT(RND(1)*125+75):WS=INT(RND(1)*9
    +1):POKE SQ,32:POKESQ+C,70
260 FORTD=1TO1000:NEXT
270 PRINT"{HOME}{BLU}{9 DOWN}"SPC(10)"
    {21 SPACES}"
280 POKE1032,35-2*WS:POKE1033,30-2*WS:POK
    E1034,40-2*WS:POKE 1040,20
290 PRINT"{BLU}{HOME}{3 SPACES}SCORE
    {2 SPACES}"SC"{LEFT} ":PRINT"{HOME}"S
    PC(23)"TROOPS "TR"{LEFT} "
300 PRINT"{HOME}{DOWN}{3 SPACES}WEIGHT "W
    T"{LEFT} ":PRINT"{HOME}{DOWN}"SPC(23)
    "WIND{3 SPACES}"WS"{LEFT} "
310 IFTR=0THEN470
320 POKE239,0:WAIT 239,1
330 SX=PEEK(1041):SY=PEEK(949)/40+3:DX=WS
    /20:DY=WT/400
340 POKESQ,32:POKESQ+40,32:SP=SX+3072+INT
    (SY)*40
350 CL=PEEK(SP+C):CO=PEEK(SP+C+40):IFCL<>
    70OR CO<>70THEN370
360 OX=SX:POKESP,34:POKESP+40,35:SX=SX+DX
    :SY=SY+DY:SQ=SP:FORA=1TO80:NEXT:GOTO3
    40
370 IFCO=50ANDSY<16THENSC=SC+75:GOSUB440:
    GOTO250
```

```
380 IFCO=68ANDSY<16THENSC=SC+50:GOSUB440:
    GOTO250
390 IFCO=53ANDSY<16THENSC=SC+25:GOSUB440:
    GOTO250
400 PRINT"{HOME}{9 DOWN}{RVS}"SPC(11)"PAR
    ATROOPER FAILED":TR=TR-1:SC=SC-10
410 R=3752+OX:IFR>3791THENR=3752
420 POKER,40:SOUND 3,700,60:FORV=7TO1STEP
    -1:VOL V:FORTD=1TO100:NEXT:NEXT
430 POKER,32:GOTO250
440 POKESQ+40,35:PRINT"{HOME}{9 DOWN}
    {RVS}"SPC(11)"SUCCESSFUL LANDING"
450 RESTORE460:VOL8:FORA=1TO4:READN1,D1,N
    2,D2:SOUND 1,N1,D1:SOUND 2,N2,D2:NEXT
460 DATA 169,10,169,10,345,20,169,20,596,
    10,685,10,685,40,739,40
462 FORV=8TO0STEP-1:VOLV:FORTD=1TO50:NEXT
    :NEXT:POKESQ+40,32:RETURN
470 PRINT"{HOME}{9 DOWN}{RVS}"SPC(10)"GAM
    E OVER HIT ANY KEY"
480 POKE65290,0:POKE788,14:POKE789,206:PO
    KE65290,162
490 POKE239,0:WAIT239,1:POKE65298,196:POK
    E65299,208:POKE65287,72:GOTO80
500 I=819:T=0:RESTORE530:PRINT"{CLR}
    {4 DOWN}"SPC(14)"PLEASE WAIT"
510 READ A:T=T+A:IFA=256THENIFT=22264THEN
    RETURNELSEPRINT"ERROR IN DATA":END
520 POKE I,A:I=I+1:GOTO 510
530 DATA 120,169,64,141,20,3
540 DATA 169,3,141,21,3,88
550 DATA 96,216,206,11,4,208
560 DATA 11,160,80,32,191,3
570 DATA 173,8,4,141,11,4
580 DATA 206,12,4,208,11,160
590 DATA 160,32,191,3,173,9
600 DATA 4,141,12,4,206,13
610 DATA 4,208,11,160,240,32
620 DATA 191,3,173,10,4,141
630 DATA 13,4,206,15,4,208
640 DATA 70,173,16,4,141,15
650 DATA 4,172,17,4,169,32
660 DATA 153,119,12,153,120,12
670 DATA 206,17,4,208,38,169
680 DATA 38,141,17,4,32,221
690 DATA 3,74,74,74,74,74
700 DATA 74,168,185,216,3,141
710 DATA 181,3,24,105,1,141
720 DATA 130,3,141,186,3,105
730 DATA 1,141,133,3,76,188
740 DATA 3,169,36,153,118,12
750 DATA 169,37,153,119,12,76
760 DATA 14,206,162,40,185,207
770 DATA 14,141,14,4,185,206
780 DATA 14,153,207,14,136,202
790 DATA 208,246,173,14,4,153
800 DATA 208,14,96,119,159,199
810 DATA 239,199,173,18,4,10
820 DATA 10,56,109,18,4,141
830 DATA 18,4,96,160,0,185
840 DATA 0,208,153,0,60,185
850 DATA 0,209,153,0,61,185
860 DATA 0,210,153,0,62,185
870 DATA 0,211,153,0,63,24
880 DATA 76,19,4,0,0,0
890 DATA 0,0,0,0,0,0
900 DATA 0,0,136,208,214,160
910 DATA 70,185,128,209,73,255
920 DATA 153,208,61,136,16,245
930 DATA 96,256
```

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Rescue Of Blondell

Grant Albrecht

"Rescue Of Blondell" is a fast-action game with smooth horizontal scrolling. All versions (Atari, Commodore 64, and VIC-20 with 8K or more expansion) are written completely in machine language and offer the challenge of artificially intelligent attacking birds. A joystick is required.

When the king summoned you before him you were sure it was for a magic carpet parking violation, but now you know better. His only daughter, Blondell, has been kidnapped by an evil sorcerer—and the king wants you to rescue her. You were chosen for the task because you're the most reputable genie in the kingdom.

The princess is being held captive in a tower. You must try to save her from the clutches of the evil sorcerer by flying your magic carpet toward the tower, picking her up, and flying back to your base. It won't be easy, though. The sorcerer owns very swift and powerful birds that he sends out to combat you. These birds are intelligent and will home in on your flying carpet. Worse, the sorcerer has bestowed some of his powers on the birds. They can summon the elements and hurl fiery lightning bolts at you.

Since you are a genie, you'll have magic on your side, but beware—magic lasts only for a while. The more times the birds crash into you or strike you with lightning bolts, the less magic you'll have left to defend yourself. You have one other defense; you, too, can summon lightning and throw bolts at your foes. Try to strike the swooping birds.

Multiple Skill Levels

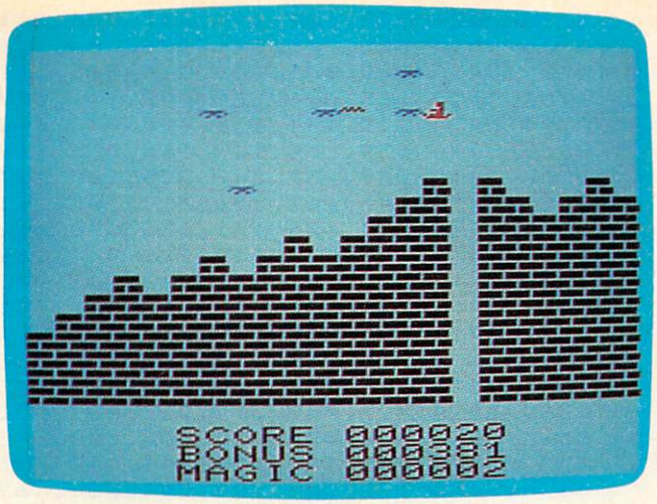
"Rescue Of Blondell" is an arcade-style game that features smooth horizontal scrolling and multiple levels of difficulty. On the Atari version, choose the level at the beginning of the game by pressing one of the number keys (1=hard, 9=easy). On the Commodore versions, you can choose the number of attacking birds (1 to 3 on the Commodore 64, and 1 to 9 on the VIC).

Once the game begins, you fly toward the right of the screen by pushing the joystick while keeping a watchful eye out for the sorcerer's birds. At the bottom of the screen is your score, the amount of magic you have left, and the bonus points you'll receive for rescuing Blondell. The Atari version awards 50 points for each bird you destroy with a lightning bolt, and 10 points for each bird that crashes into the ground while in wild pursuit of your flying carpet. The Commodore versions award only 10 points for birds, no matter how they meet their end. In all versions, the rescue bonus decreases with time, so you might want to be expedient in your quest.

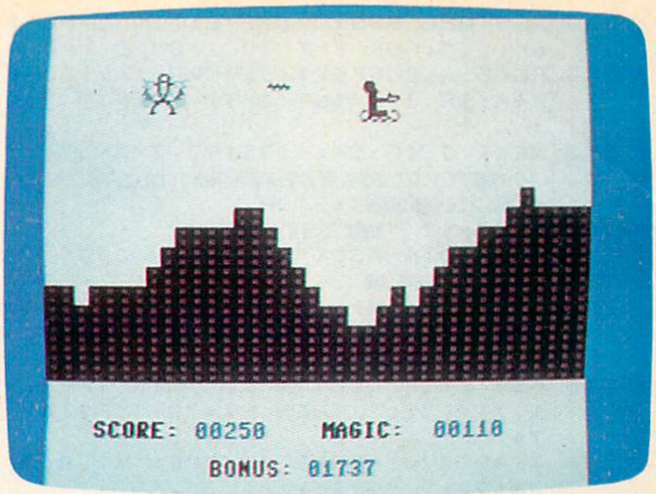
Remember that the king is counting on you to rescue Blondell, so don't retreat to your base until you have her. Trying to land on your base without Blondell has unfortunate results.

Program 1, for the Atari, is a BASIC program with the machine language for Rescue Of Blondell in DATA statements. The program gives you the options of using this data to create either a boot tape (select option B) or a binary file on disk (select option D). Make sure that the disk or tape on which you wish the machine language to be stored is in the drive when you run the program. The BASIC program will check the DATA for typing errors, then write out the machine language file.

If you use Program 1 to create a boot tape, you start the game by turning off the computer and removing the BASIC cartridge if one is present (and turning off the disk drive, if you have one connected), then mounting and rewinding the boot tape. Next, hold down the START button (both the START and OPTION buttons if you have a 600XL or 800XL) and turn the computer on. When the Atari beeps, press PLAY on the recorder and then RETURN. The tape should load and the game screen will appear. If you created a binary file on disk, go to the DOS menu and use the L option to load the binary file you created. The game will start automatically after it is loaded. Alternatively, if you use the name



Swarms of hostile birds attack this genie as he hovers over the tunnel leading to the imprisoned Blondell (VIC version).



The genie is being pursued by one of the evil sorcerer's dreaded birds (64 version).

AUTORUN.SYS for the file you create, it will load and run automatically whenever you boot the disk.

Commodore 64 And VIC-20 Notes

Both the Commodore 64 and VIC-20 versions of "Rescue Of Blondell" are written entirely in machine language and are presented as BASIC loader programs. Programs 2 and 3 POKE the machine language stored in DATA statements into memory, then use a SYS to start the game. Both programs check the DATA statements for typing errors.

To use the VIC version, at least 8K of memory expansion is required. It is necessary to reconfigure memory before loading this version; otherwise, the program will overwrite itself as it executes. To reconfigure memory, enter the following two lines in direct mode (no line numbers), pressing RETURN after each, *before* loading Program 3:

```
POKE 44,32:POKE 32*256,0:NEW
POKE 648,30:SYS 58648
```

The Commodore 64 version of Rescue Of Blondell offers a choice of from one to three attack birds to add to the challenge, while the VIC version allows up to nine. Although the birds in the VIC version do not fire, eventually they may overwhelm you by their numbers.

The princess in the Commodore 64 version is at the top of the tower. To save her, simply approach her with your genie. After a safe rendezvous, she disappears and your genie turns blue. In the VIC version, the princess is held captive at the bottom of a deep tunnel. To save her, you must fly to the bottom of the tunnel and land. Then a secret door opens and the princess becomes visible. Just touch her to pick her up. Finally, carry her back to your base through the swarming attack birds.

For the Commodore 64, plug the joystick into port 2.

Program 1: Rescue Of Blondell, Atari Version

Please refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
AB 100 GRAPHICS 0:? :? :? "[illegible]
       BLONDELL":BEG=8192:FIN=10064
       :STARTADR=8192
IG 110 BYTS=FIN-BEG:DIM BUFFER$(BYTS+
       127),T$(20),F$(20),CIO$(7)
OE 120 OPEN #1,4,0,"K:":? :? "Boot Ta
       pe or Disk Binary File:";
NB 130 BUFFER$=CHR$(0):BUFFER$(FIN-BE
       G+30)=BUFFER$:BUFFER$(2)=BUFFE
       R$
BN 140 I=1:T=10:CIO$="hhh":CIO$(4)=CH
       R$(170):CIO$(5)="LV":CIO$(7)=C
       HR$(228)
EF 150 GET #1,MEDIA:IF MEDIA<>66 AND
       MEDIA<>68 THEN 150
OI 160 ? CHR$(MEDIA):? :IF MEDIA<>ASC
       ("B") THEN BUFFER$="":GOTO 230
PJ 170 BEG=BEG-24:BUFFER$=CHR$(0):BUF
       FER$(2)=CHR$(INT((FIN-BEG+127)
       /128))
KM 180 H=INT(BEG/256):L=BEG-H*256:BUF
       FER$(3)=CHR$(L):BUFFER$(4)=CHR
       $(H)
EJ 190 PINIT=BEG+8:H=INT(PINIT/256):L
       =PINIT-H*256:BUFFER$(5)=CHR$(L
       ):BUFFER$(6)=CHR$(H)
OP 200 FOR I=7 TO 24:READ A:BUFFER$(I
       )=CHR$(A):NEXT I:DATA 24,96,16
       9,60,141,2,211,169,0,133,10,16
       9,0,133,11,76,0,0
DN 210 H=INT(STARTADR/256):L=STARTADR
       -H*256:BUFFER$(15)=CHR$(L):BUF
       FER$(19)=CHR$(H)
KJ 220 BUFFER$(23)=CHR$(L):BUFFER$(24
       )=CHR$(H)
```

```
NA 230 RESTORE BEG:? :? "Filling buff
       er...":FOR J=I TO I+BYTS
GI 240 READ A:BUFFER$(J)=CHR$(A):CK=C
       K+A:IF J/T=INT(J/T) THEN ? "*"
       ;
HN 250 NEXT J:IF CK<>195192 THEN ? :?
        "  ERROR DETECTED IN DATA STA
       TEMENTS!  ":STOP
OB 260 ? :? :? "  DATA OK  "
DO 270 IF MEDIA=ASC("B") THEN 390
OJ 280 REM  DISK 
PL 290 ? :? "Enter filename":? :? "(U
       se AUTORUN.SYS for automatic u
       se)":? :INPUT T$
FK 300 F$=T$:IF LEN(T$)>2 THEN IF T$(
       1,2)<>"D:" THEN F$="D:":F$(3)=
       T$
CF 310 TRAP 370:CLOSE #2:OPEN #2,8,0,
       F$:? :? "Writing..."
PL 320 PUT #2,255:PUT #2,255
DG 330 H=INT(BEG/256):L=BEG-H*256:PUT
        #2,L:PUT #2,H:H=INT(FIN/256):
       L=FIN-H*256:PUT #2,L:PUT #2,H
MG 340 GOSUB 450:IF PEEK(195)>1 THEN
       370
EP 350 PUT #2,224:PUT #2,2:PUT #2,225
       :PUT #2,2:H=INT(STARTADR/256):
       L=STARTADR-H*256:PUT #2,L:PUT
       #2,H
AE 360 TRAP 32767:CLOSE #2:? "Finishe
       d.":END
FH 370 ? "Error ";PEEK(195);" trying
       to access":? F$:CLOSE #2:? :GO
       TO 290
LN 380 REM  BOOT TAPE 
AL 390 ? :? :? "Insert, Rewind Tape."
       :? "Press PLAY & RECORD":? :?
       "Press RETURN when ready.";
OE 400 TRAP 430:CLOSE #2:OPEN #2,8,12
       8,"C:":? :? "Writing..."
MB 410 GOSUB 450:IF PEEK(195)>1 THEN
       430
PD 420 CLOSE #2:TRAP 32767:? "Finishe
       d.":? :? :END
AN 430 ? :? "Error ";PEEK(195);" when
        writing boot tape":? :CLOSE #
       2:GOTO 390
HL 440 REM CIO Save File#2
HA 450 X=32:ICCOM=834:ICBADR=836:ICBL
       EN=840:ICSTAT=835
JM 460 H=INT(ADR(BUFFER$)/256):L=ADR(
       BUFFER$)-H*256:POKE ICBADR+X,L
       :POKE ICBADR+X+1,H
DA 470 L=FIN-BEG+1:H=INT(L/256):L=L-H
       *256:POKE ICBLEN+X,L:POKE ICBL
       EN+X+1,H
PF 480 POKE ICCOM+X,11:A=USR(ADR(CIO$
       ),X)
OP 490 POKE 195,PEEK(ICSTAT):RETURN
FE 8192 DATA 032,007,035,169,000,141
FD 8198 DATA 060,006,141,050,006,141
EN 8204 DATA 066,006,141,008,210,141
EC 8210 DATA 000,208,141,001,208,141
EM 8216 DATA 002,208,141,003,208,141
FE 8222 DATA 076,006,169,004,141,111
FC 8228 DATA 002,169,010,141,054,006
FE 8234 DATA 141,053,006,169,003,141
EG 8240 DATA 015,210,169,100,141,002
FI 8246 DATA 210,169,232,141,071,006
GH 8252 DATA 169,016,141,234,037,169
FH 8258 DATA 003,141,072,006,169,200
FG 8264 DATA 141,073,006,169,000,141
FI 8270 DATA 049,006,141,057,006,141
FH 8276 DATA 059,006,141,004,006,141
EM 8282 DATA 000,006,141,064,006,141
GK 8288 DATA 065,006,169,048,141,007
FO 8294 DATA 212,141,058,006,032,068
FP 8300 DATA 034,160,168,162,035,169
FN 8306 DATA 007,032,092,228,169,120
EM 8312 DATA 141,002,006,169,103,141
EK 8318 DATA 033,006,141,003,006,032
FM 8324 DATA 145,038,032,211,034,169
ED 8330 DATA 001,141,111,002,169,003
FM 8336 DATA 141,029,208,169,001,141
EN 8342 DATA 030,208,032,070,035,032
FJ 8348 DATA 060,036,032,145,036,032
FJ 8354 DATA 015,037,032,184,035,032
FE 8360 DATA 221,035,032,237,037,032
FL 8366 DATA 060,036,173,004,208,240
FB 8372 DATA 005,169,000,141,051,006
GH 8378 DATA 173,007,208,240,005,169
FC 8384 DATA 001,141,062,006,173,005
FB 8390 DATA 208,201,001,208,044,160
GB 8396 DATA 012,185,081,038,153,003
GB 8402 DATA 059,136,016,247,032,237
FH 8408 DATA 037,169,207,141,001,210
ED 8414 DATA 160,125,140,000,210,140
FA 8420 DATA 193,002,166,020,228,020
FD 8426 DATA 240,252,200,208,241,160
FE 8432 DATA 000,140,029,208,076,150
GC 8438 DATA 037,201,008,208,024,169
FD 8444 DATA 001,141,066,006,169,000
FA 8450 DATA 141,250,061,141,250,062
FN 8456 DATA 162,050,032,096,037,202
FF 8462 DATA 208,250,076,031,033,201
GB 8468 DATA 002,208,008,173,066,006
GI 8474 DATA 240,175,076,114,037,173
GB 8480 DATA 067,006,240,044,206,068
FJ 8486 DATA 006,208,021,169,000,141
GK 8492 DATA 067,006,141,235,037,169
GB 8498 DATA 001,141,053,006,169,216
FI 8504 DATA 141,194,002,076,161,033
FH 8510 DATA 173,068,006,074,141,003
FD 8516 DATA 210,074,074,024,105,040
FM 8522 DATA 141,235,037,076,161,033
GE 8528 DATA 173,006,208,240,024,169
FM 8534 DATA 032,141,068,006,141,067
FF 8540 DATA 006,169,000,141,057,006
GE 8546 DATA 169,246,141,194,002,032
GJ 8552 DATA 096,037,076,161,033,173
EP 8558 DATA 014,208,201,001,208,011
FM 8564 DATA 162,004,032,096,037,202
FO 8570 DATA 208,250,076,085,033,201
FI 8576 DATA 002,240,210,206,069,006
GC 8582 DATA 208,005,169,100,141,069
GB 8588 DATA 006,173,069,006,201,050
GJ 8594 DATA 144,008,169,008,141,235
FJ 8600 DATA 037,076,161,033,169,000
FN 8606 DATA 141,235,037,173,013,208
EO 8612 DATA 201,004,144,005,206,073
FM 8618 DATA 006,240,050,173,076,006
GC 8624 DATA 208,029,206,074,006,208
FJ 8630 DATA 024,173,071,006,056,233
FG 8636 DATA 001,141,071,006,173,072
EN 8642 DATA 006,233,000,141,072,006
GC 8648 DATA 240,008,169,030,141,074
GE 8654 DATA 006,076,147,032,173,071
FK 8660 DATA 006,208,243,169,001,141
GH 8666 DATA 076,006,076,202,033,076
FB 8672 DATA 203,032,169,112,141,000
EO 8678 DATA 042,141,001,042,141,002
FL 8684 DATA 042,162,020,160,003,169
FO 8690 DATA 060,141,001,006,169,086
EP 8696 DATA 153,000,042,200,173,000
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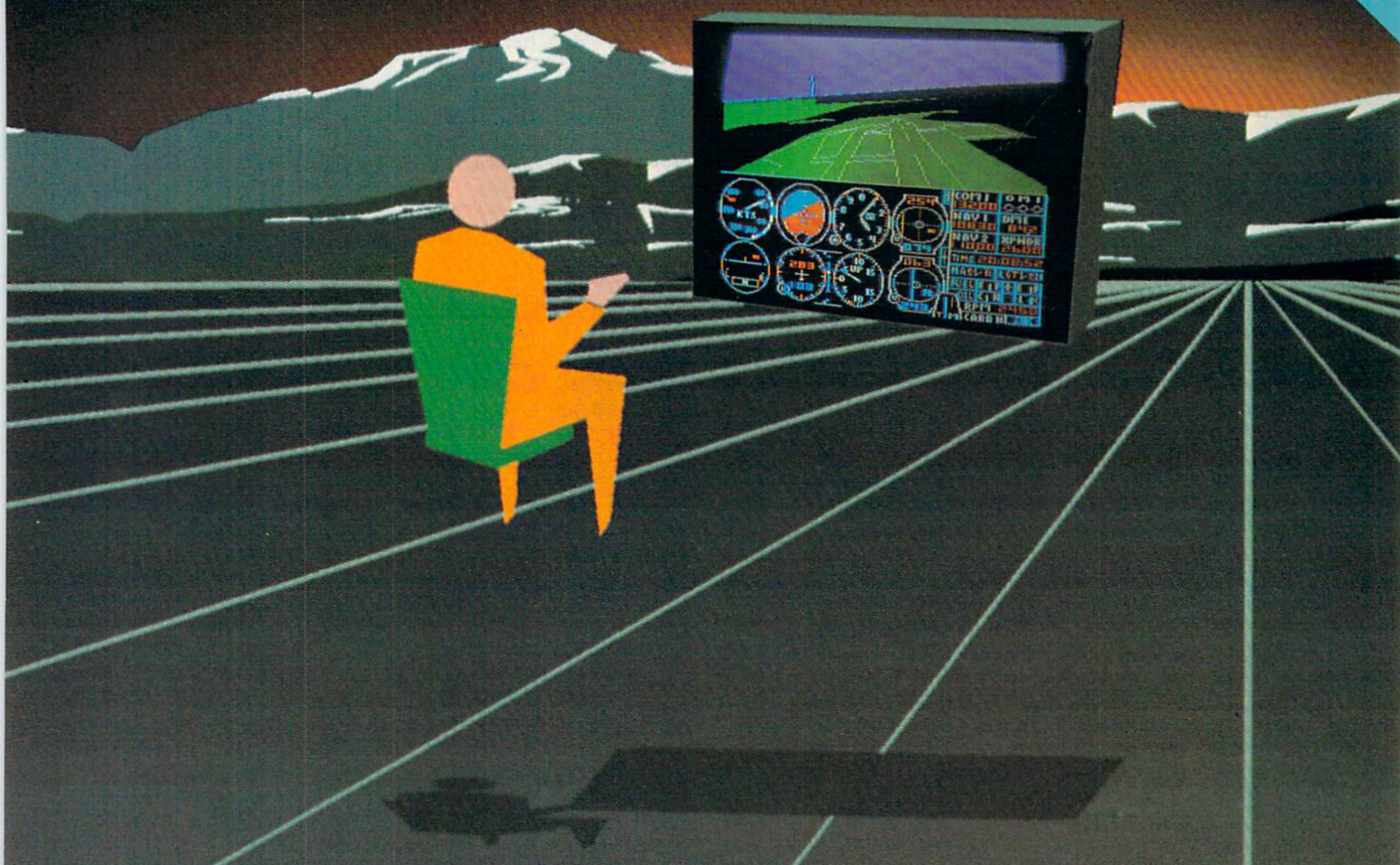

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```
EI 8702 DATA 006,153,000,042,173,001
EG 8708 DATA 006,200,153,000,042,200
FB 8714 DATA 238,001,006,202,208,230
FN 8720 DATA 169,070,153,000,042,169
EO 8726 DATA 000,200,153,000,042,169
EL 8732 DATA 059,200,153,000,042,200
GB 8738 DATA 169,006,153,000,042,192
GO 8744 DATA 068,208,246,200,169,065
EL 8750 DATA 153,000,042,169,000,200
FD 8756 DATA 153,000,042,141,048,002
FE 8762 DATA 169,042,200,153,000,042
GB 8768 DATA 141,049,002,096,162,001
EK 8774 DATA 160,000,032,140,034,200
FM 8780 DATA 192,010,208,248,162,010
FI 8786 DATA 032,140,034,200,192,015
FK 8792 DATA 208,248,173,010,210,201
FP 8798 DATA 150,144,008,224,004,240
FF 8804 DATA 009,202,076,110,034,224
EI 8810 DATA 018,240,001,232,032,140
FP 8816 DATA 034,200,192,250,208,228
EH 8822 DATA 162,001,032,140,034,200
GH 8828 DATA 208,250,160,004,169,065
FG 8834 DATA 153,010,070,136,016,250
GE 8840 DATA 032,187,034,096,134,205
GC 8846 DATA 169,000,133,203,169,060
FD 8852 DATA 133,204,162,000,169,000
GA 8858 DATA 145,203,230,204,232,228
GJ 8864 DATA 205,208,247,169,001,145
EO 8870 DATA 203,230,204,232,224,020
HM 8876 DATA 208,247,166,205,169,194
GJ 8882 DATA 141,250,061,169,195,141
GN 8888 DATA 250,062,096,160,004,185
HI 8894 DATA 096,038,153,024,059,185
GB 8900 DATA 101,038,153,044,059,185
GK 8906 DATA 106,038,153,064,059,136
GG 8912 DATA 016,235,096,160,016,185
HA 8918 DATA 199,038,153,001,059,136
GM 8924 DATA 016,247,169,255,141,252
FD 8930 DATA 002,173,252,002,162,008
FJ 8936 DATA 221,216,038,240,006,202
GN 8942 DATA 016,248,076,227,034,138
EE 8948 DATA 010,010,010,105,020,141
GA 8954 DATA 075,006,160,016,169,000
FN 8960 DATA 153,001,059,136,016,250
GN 8966 DATA 096,169,062,141,047,002
FB 8972 DATA 169,001,141,111,002,032
HI 8978 DATA 047,035,169,166,141,192
GD 8984 DATA 002,141,193,002,169,216
FN 8990 DATA 141,194,002,141,195,002
GC 8996 DATA 169,001,160,003,153,008
GC 9002 DATA 208,136,016,250,096,169
FC 9008 DATA 052,133,204,169,000,133
EO 9014 DATA 203,162,029,160,000,145
EF 9020 DATA 203,200,208,251,230,204
FO 9026 DATA 202,208,244,096,172,033
EJ 9032 DATA 006,174,002,006,173,000
FM 9038 DATA 211,074,176,005,192,040
FG 9044 DATA 240,001,136,074,176,005
EG 9050 DATA 192,200,240,001,200,074
GB 9056 DATA 072,176,031,169,024,141
FH 9062 DATA 234,037,224,080,208,021
FJ 9068 DATA 238,004,006,173,004,006
FH 9074 DATA 201,008,208,008,169,000
EF 9080 DATA 141,004,006,206,000,006
FK 9086 DATA 076,130,035,202,104,074
GG 9092 DATA 176,026,169,016,141,234
GB 9098 DATA 037,224,150,208,016,206
FE 9104 DATA 004,006,016,008,169,007
EE 9110 DATA 141,004,006,238,000,006
FD 9116 DATA 076,160,035,232,142,002
FA 9122 DATA 006,140,033,006,096,024
FC 9128 DATA 216,173,004,006,141,004
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EN 9134 DATA 212,032,226,033,032,232
GJ 9140 DATA 035,076,098,228,173,053
FH 9146 DATA 006,141,034,006,173,054
EM 9152 DATA 006,141,002,208,173,002
FE 9158 DATA 006,141,001,208,173,050
FB 9164 DATA 006,141,000,208,173,060
FC 9170 DATA 006,141,003,208,173,061
FP 9176 DATA 006,141,035,006,096,162
GA 9182 DATA 005,160,255,136,208,253
GL 9188 DATA 202,208,248,096,169,000
GC 9194 DATA 141,048,006,173,048,006
FA 9200 DATA 168,024,105,052,133,204
EJ 9206 DATA 169,000,105,000,133,203
FO 9212 DATA 185,016,006,168,169,000
FA 9218 DATA 162,008,145,203,200,202
GC 9224 DATA 208,250,172,048,006,185
FF 9230 DATA 233,037,024,105,193,141
FP 9236 DATA 039,036,169,037,105,000
FD 9242 DATA 141,040,036,185,032,006
FL 9248 DATA 153,016,006,168,162,000
GF 9254 DATA 189,255,255,145,203,200
GA 9260 DATA 232,224,008,208,245,238
FP 9266 DATA 048,006,173,048,006,201
GP 9272 DATA 004,208,178,096,173,049
FH 9278 DATA 006,208,040,173,132,002
FL 9284 DATA 208,034,173,033,006,141
FD 9290 DATA 032,006,173,002,006,056
FM 9296 DATA 233,003,141,050,006,169
EO 9302 DATA 050,141,051,006,141,049
FL 9308 DATA 006,173,234,037,141,052
EM 9314 DATA 006,169,005,141,001,210
FE 9320 DATA 096,173,052,006,201,024
FK 9326 DATA 208,006,206,050,006,076
FE 9332 DATA 121,036,238,050,006,206
FD 9338 DATA 051,006,016,012,169,000
FE 9344 DATA 141,049,006,141,032,006
FB 9350 DATA 141,001,210,096,173,051
FG 9356 DATA 006,141,000,210,096,173
FO 9362 DATA 067,006,240,001,096,173
GF 9368 DATA 055,006,208,036,172,053
FK 9374 DATA 006,204,033,006,046,056
FI 9380 DATA 006,174,054,006,236,002
FN 9386 DATA 006,046,056,006,173,010
GB 9392 DATA 210,237,075,006,205,075
HB 9398 DATA 006,176,248,109,075,006
GC 9404 DATA 141,055,006,096,173,056
FG 9410 DATA 006,074,072,144,013,173
FE 9416 DATA 054,006,201,045,144,006
FK 9422 DATA 206,054,006,076,222,036
FN 9428 DATA 173,054,006,201,203,176
FP 9434 DATA 243,238,054,006,104,074
GD 9440 DATA 176,006,238,053,006,076
GB 9446 DATA 245,036,206,053,006,208
FO 9452 DATA 008,238,053,006,169,001
FO 9458 DATA 141,055,006,206,055,006
FG 9464 DATA 173,053,006,205,003,006
EP 9470 DATA 240,009,173,010,210,205
GM 9476 DATA 058,006,144,001,096,169
GA 9482 DATA 001,141,057,006,096,173
HB 9488 DATA 059,006,208,045,173,057
FM 9494 DATA 006,240,033,173,054,006
EP 9500 DATA 141,060,006,173,053,006
FI 9506 DATA 141,061,006,169,050,141
FK 9512 DATA 062,006,141,059,006,173
FE 9518 DATA 054,006,205,002,006,144
FF 9524 DATA 006,169,000,141,063,006
FM 9530 DATA 096,169,001,141,063,006
GC 9536 DATA 096,173,063,006,240,006
GK 9542 DATA 238,060,006,076,079,037
FK 9548 DATA 206,060,006,206,062,006
FN 9554 DATA 208,011,169,000,141,059
FE 9560 DATA 006,141,057,006,141,060
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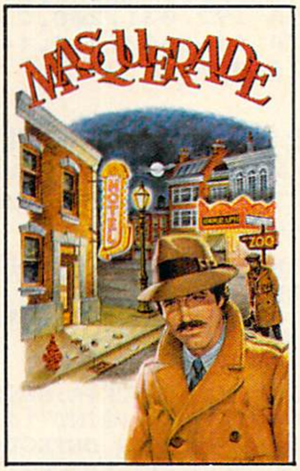

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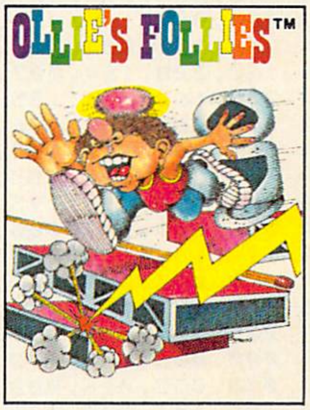

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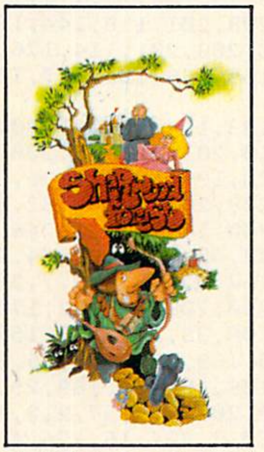

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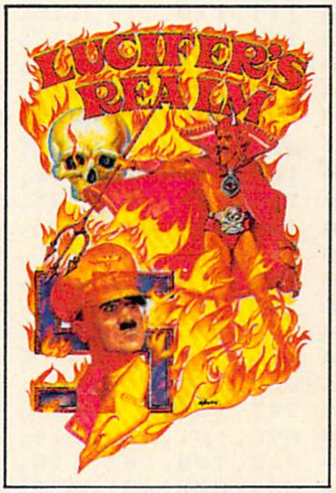

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GG 9566 DATA 006,096,173,064,006,024
FF 9572 DATA 105,010,141,064,006,173
FL 9578 DATA 065,006,105,000,141,065
GJ 9584 DATA 006,096,160,012,185,066
GD 9590 DATA 038,153,003,059,136,016
GJ 9596 DATA 247,173,071,006,024,109
FI 9602 DATA 064,006,141,064,006,173
FN 9608 DATA 072,006,109,065,006,141
FL 9614 DATA 065,006,032,237,037,032
EO 9620 DATA 031,039,169,000,141,001
FE 9626 DATA 210,141,003,210,160,098
GG 9632 DATA 162,228,169,007,032,092
GA 9638 DATA 228,160,010,185,111,038
GL 9644 DATA 153,063,059,136,016,247
GC 9650 DATA 169,255,141,252,002,173
FP 9656 DATA 252,002,201,255,240,249
FK 9662 DATA 076,000,032,195,060,024
EC 9668 DATA 036,000,000,000,000,060
EO 9674 DATA 114,165,129,000,000,000
FC 9680 DATA 000,000,048,050,039,062
GK 9686 DATA 048,189,126,000,012,076
GB 9692 DATA 228,124,012,189,126,000
DM 9698 DATA 000,003,003,000,000,000
EL 9704 DATA 000,032,016,000,032,169
FJ 9710 DATA 009,141,070,006,174,064
FJ 9716 DATA 006,173,065,006,032,023
GD 9722 DATA 038,169,029,141,070,006
GE 9728 DATA 174,071,006,173,072,006
GF 9734 DATA 032,023,038,169,049,141
GD 9740 DATA 070,006,174,073,006,169
FM 9746 DATA 000,032,023,038,096,134
FG 9752 DATA 212,133,213,032,170,217
FD 9758 DATA 032,230,216,160,000,132
FO 9764 DATA 031,177,243,072,041,031
GA 9770 DATA 238,070,006,174,070,006
GG 9776 DATA 157,020,059,104,048,005
GC 9782 DATA 164,031,200,208,232,169
GJ 9788 DATA 000,232,157,020,059,096
HM 9794 DATA 185,175,181,128,179,161
GP 9800 DATA 182,165,164,128,168,165
IA 9806 DATA 178,129,096,176,175,175
HP 9812 DATA 178,128,176,178,169,174
ID 9818 DATA 163,165,179,179,129,096
GC 9824 DATA 115,099,111,114,101,098
FJ 9830 DATA 111,110,117,115,109,097
GF 9836 DATA 103,105,099,232,233,244
HE 9842 DATA 192,225,238,249,192,235
HA 9848 DATA 229,249,254,254,254,000
GA 9854 DATA 239,239,239,000,000,024
FH 9860 DATA 036,102,024,060,126,126
GG 9866 DATA 102,060,126,126,255,255
FJ 9872 DATA 255,160,000,185,000,224
GB 9878 DATA 153,000,056,185,000,225
GA 9884 DATA 153,000,057,185,000,226
GE 9890 DATA 153,000,058,136,208,235
GE 9896 DATA 160,007,141,244,002,185
GA 9902 DATA 122,038,153,008,056,136
GD 9908 DATA 016,247,160,015,185,130
GE 9914 DATA 038,153,016,056,136,016
GE 9920 DATA 247,169,056,141,244,002
FD 9926 DATA 096,101,110,116,101,114
FH 9932 DATA 064,108,101,118,101,108
HI 9938 DATA 064,072,081,077,089,073
FJ 9944 DATA 031,030,026,024,029,027
FJ 9950 DATA 051,053,048,060,060,060
FE 9956 DATA 081,072,081,000,000,060
FH 9962 DATA 060,060,081,072,081,000
GD 9968 DATA 081,072,081,000,081,072
GH 9974 DATA 081,000,081,091,096,108
FI 9980 DATA 108,121,121,121,243,217
GA 9986 DATA 193,243,182,243,000,000
HA 9992 DATA 243,217,193,243,182,243
FP 9998 DATA 000,243,182,243,000,243
HO 10004 DATA 182,243,000,243,182,182
HM 10010 DATA 162,162,243,243,243,160
FP 10016 DATA 000,140,001,210,140,003
HK 10022 DATA 210,169,239,141,005,210
ID 10028 DATA 141,007,210,185,225,038
HF 10034 DATA 141,004,210,185,000,039
GO 10040 DATA 141,006,210,165,020,105
HL 10046 DATA 020,197,020,208,252,200
HO 10052 DATA 192,031,208,231,169,000
HC 10058 DATA 141,005,210,141,007,210
LE 10064 DATA 096
```

Program 2: Rescue Of Blondell, 64 Version

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 PRINT"{CLR}{3 DOWN}"TAB(11)"E5∃{RVS}RE
   SCUE OF BLONDELL"                 :rem 24
20 PRINT"{4 DOWN}"TAB(12)"{CYN}{RVS}ENTER
   ING ML DATA"                       :rem 6
30 FOR I=49152 TO 51972             :rem 128
40 READ A:POKE I,A:CK=CK+A:NEXT      :rem 88
50 IF CK<>318395 THEN PRINT"{3 DOWN}E7∃
   {RVS}{3 SPACES}ERROR DETECTED IN DATA
   {SPACE}STATEMENTS{4 SPACES}":STOP
                                     :rem 29
60 SYS 49152                        :rem 106
49152 DATA 76,46,202,32,145,196       :rem 5
49158 DATA 32,151,195,32,142,194     :rem 54
49164 DATA 32,197,193,32,222,193     :rem 57
49170 DATA 32,164,195,32,209,201     :rem 45
49176 DATA 173,31,208,165,2,208       :rem 2
49182 DATA 57,173,60,3,201,232      :rem 200
49188 DATA 240,3,76,125,192,173       :rem 9
49194 DATA 61,3,201,65,240,3         :rem 98
49200 DATA 76,125,192,162,50,32     :rem 249
49206 DATA 50,193,202,208,250,169    :rem 98
49212 DATA 6,141,39,208,162,32      :rem 200
49218 DATA 142,2,68,142,3,68        :rem 109
49224 DATA 142,2,70,142,3,70         :rem 92
49230 DATA 169,1,133,2,32,164       :rem 146
49236 DATA 195,76,125,192,169,13     :rem 66
49242 DATA 205,60,3,169,64,237      :rem 209
49248 DATA 61,3,144,25,173,1        :rem 103
49254 DATA 208,201,118,144,18,173    :rem 98
49260 DATA 0,208,201,114,176,11     :rem 238
49266 DATA 169,168,133,113,169,198
                                    :rem 174
49272 DATA 133,114,76,107,202,32     :rem 41
49278 DATA 60,201,32,174,200,32     :rem 245
49284 DATA 78,199,32,53,196,206      :rem 24
49290 DATA 248,207,208,8,32,35      :rem 212
49296 DATA 200,169,2,141,248,207     :rem 53
49302 DATA 32,60,201,32,174,200     :rem 233
49308 DATA 162,0,189,249,7,201      :rem 210
49314 DATA 250,208,40,222,170,2     :rem 240
49320 DATA 208,35,169,253,157,52     :rem 56
49326 DATA 3,169,252,157,55,3       :rem 164
49332 DATA 138,10,168,169,25,153     :rem 55
49338 DATA 3,208,173,27,212,174       :rem 3
49344 DATA 60,3,224,15,176,4        :rem 103
49350 DATA 201,120,144,242,153,2     :rem 29
49356 DATA 208,232,228,20,208,204    :rem 96
49362 DATA 173,31,208,72,74,144       :rem 4
49368 DATA 20,32,211,202,169,10     :rem 244
49374 DATA 133,113,169,199,133,114
                                    :rem 157
49380 DATA 169,0,133,106,133,107     :rem 43
49386 DATA 76,107,202,104,13,30     :rem 249
49392 DATA 208,74,144,13,206,167     :rem 57
```

A Printer For All Reasons

Search For The Best High Quality Graphic Printer

If you have been looking very long, you have probably discovered that there are just too many claims and counterclaims in the printer market today. There are printers that have some of the features you want, but do not have others. Some features you probably don't care about; others are vitally important to you. We understand. In fact, not long ago, we were in the same position. Deluged by claims and counterclaims. Overburdened by rows and rows of specifications, we decided to separate all the facts — prove or disprove all the claims to our own satisfaction. So we bought printers. We bought samples of all major brands and tested them.

Our Objective Was Simple

We wanted to find that printer which had all the features you could want and yet be sold directly to you at the lowest price. We wanted to give our customers the best printer on the market today at a bargain price.

The Results Are In

The search is over. We hae reduced the field to a single printer that meets all our goals (and more). The printer is the GP-550 from Seikosha, a division of Seiko. We ran this printer through our battery of tests and it came out shining. This printer *can* do it all. Standard draft printing up to a respectable (and honest) 86 characters per second, and with a very readable 9 (horizontal) by 8 (vertical) character matrix. At this rate, you will get an average 30 line letter printed in only 28 seconds.

"NLQ" Mode

One of our highest concerns was about print quality and readability. The GP-550 has a print mode termed Near Letter Quality printing (NLQ mode). This is where the GP-550 outshines all the competition. Hands down! The character matrix in NLQ mode is a very dense 9 (horizontal) by 16 (vertical). This equates to 14,400 addressable dots per square inch. Now we're talking *quality* printing. You can even do graphics in the high resolution mode. The results are the best we've ever seen. The only other printers currently available having resolution this high go for $500 and more *without* the interface or cable needed to hook up to your computer.

Features That Won't Quit

With the GP-550 your computer can now print 40, 48, 68, 80, 96, or 136 characters per line. You can print in ANY of 18 font styles. You not only have the standard Pica, Elite, Condensed and Italics, but also true Superscripts and Subscripts. Never again will you have to worry about how to print H_2O or X^2. This fantastic machine will do it automatically, through easy software commands right from your keyboard. All fonts have true descenders.

One of the fonts we like best is "Proportional" because it looks most like typesetting. The spacing for thin characters like "i" and "l" are given less space which "tightens" the word making reading easier and faster. This is only one example of the careful planning put into the GP-550.

NEW
As Low As
$249.95

Do you sometimes want to emphasize a word? It's easy, just use **bold** (double strike) to make the words stand out. Or, if you wish to be even more emphatic, underline the words. Or do **both.** You may also wish to "headline" a title. Each basic font has a corresponding elongated (double-wide) version. You can combine any of these modes to make the variation almost endless. Do you wnat to express something that you can't do with words? Use graphics with your text — even on the same line.

You can now do virtually any line spacing you want. You may select 6, 8, 7½ or 12 lines per inch. PLUS you have variable line spacing of 1.2 lines per inch to infinity (no space at all) and 97 other software selectable settings in between. You control line spacing on a dot-by-dot basis. If you've ever had a letter or other document that was just a few lines too long to fit a page, you can see how handy this feature is. Simply reduce the line spacing slightly and ... VOILA! The letter now fits on one page.

Forms? Yes!
Your Letterhead? Of Course!

Do you print forms? No problem. This unit will do them all. Any form up to 10 inches wide. The tractors are adjustable from 4½ to 10 inches. Yes, you can also use single sheets. Plain typing paper, your letterhed, short memo forms, anything you choose. Any size under 10" in width. Multiple copies? Absolutely! Put forms or individual sheets with carbons (up to 3 deep), and the last copy will be as readable as the first. Spread sheets with many columns? Of course! Just go to condensed mode printing and print a full 136 columns wide. Forget expensive wide-carriage printers and changing to wide carriage paper. You can no do it all on a standard 8½" page.

Consistent Print Quality

Most printers have a continuous loop ribbon cartridge or a single spool ribbon which gives nice dark printing when new, but quickly starts to fade after a while. To keep the printers' output looking consistently dark, the ribbons must be changed more often than is healthy for the pocketbok. The GP-550 solves this problem completely by using a replaceable, inexpensive ink cassette which is separately replaceable from the actual ribbon. It keeps the ribbon loaded with ink at all times. You only replace the ribbon when it truly wears out, not when it starts to run low on ink. Just another example of the superb engineering applied to the GP-550. (When you finally do wear out your ribbon, replacement cost is only $10.95. Ink cassette replacement cost is only $5.95, both postpaid.)

The Best Part

When shopping for a quality printer with all these features, you could expect to pay around $500 or more. *Not any more!* We have done our homework. You don't have to worry about interfaces or cables. Everything is included. You need absolutely nothing else to start printing — just add paper.

No Risk Offer

We give you a 15-day satisfaction guarantee. If you are not completely satisfied for any reason we will refund the full purchase price. A 1-year warranty is included with your printer.

The Bottom Dollar

GP-550A	*Standard Parallel (No Cable)*	*$249.95*
GP-550CD	*Commodore (Direct Connect)*	*$259.95*
GP-550AT	*Atari (Direct Connect)*	*$259.95*
GP-550AP	*Apple II or IIe (Direct Connect)*	*$299.95*
GP-550PC	*IBM PC & Compatables (No Cable)*	*$259.95*
GP-550TI	*TI 99/4A (Direct Connect)*	*$299.95*

"Prices & Availability Subject to Change. CALL!"

Shipping is $8.00 — UPS within the continental USA. If you are in a hurry, UPS Blue (second day air) is $18.00. Canada, Alaska, Mexico are $25.00 (air). Other foreign is $60.00 (air). California residents add 6% tax. These are cash prices — VISA and MC add 3% to total. We ship the next business day on money orders, cashiers' checks, and charge cards. A 14-day clearing period is required for checks.

TO ORDER CALL TOLL FREE
1-(800) 962-5800 USA
OR 1-(800) 962-3800 CALIF.

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APROPOS TECHNOLOGY
1071-A Avenida Acaso
Camarillo, CA 93010

Technical Info: 1-(805) 482-3604

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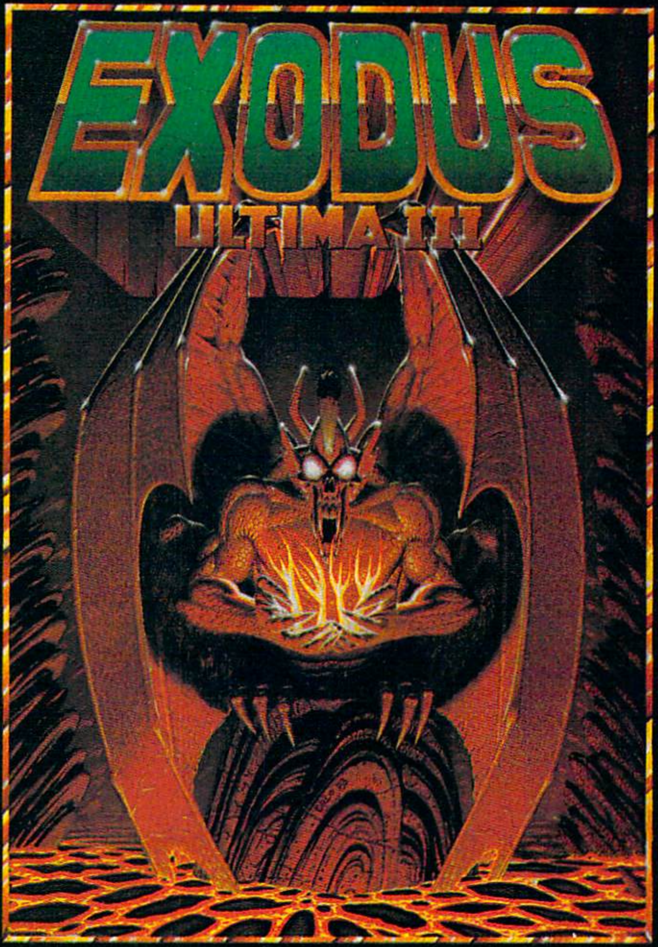
```
49398 DATA 2,174,167,2,224,255   :rem 217
49404 DATA 208,3,76,217,192,160    :rem 2
49410 DATA 0,74,72,144,26,185    :rem 155
49416 DATA 249,7,201,250,240,19  :rem 254
49422 DATA 32,50,193,169,20,153  :rem 253
49428 DATA 170,2,169,250,153,52    :rem 2
49434 DATA 3,153,55,3,153,249    :rem 159
49440 DATA 7,104,200,196,20,208  :rem 245
49446 DATA 220,173,141,2,208,251  :rem 42
49452 DATA 32,68,193,76,27,192   :rem 224
49458 DATA 173,168,2,24,105,10   :rem 205
49464 DATA 141,168,2,173,169,2   :rem 213
49470 DATA 105,0,141,169,2,96    :rem 155
49476 DATA 173,168,2,133,253,173  :rem 60
49482 DATA 169,2,133,254,169,130  :rem 57
49488 DATA 141,249,207,32,120,193:rem 106
49494 DATA 173,167,2,133,253,169  :rem 64
49500 DATA 0,133,254,169,147,141  :rem 44
49506 DATA 249,207,32,120,193,165:rem 103
49512 DATA 106,133,253,165,107,133
                                 :rem 142
49518 DATA 254,169,218,141,249,207
                                 :rem 165
49524 DATA 32,120,193,96,160,9   :rem 210
49530 DATA 169,0,141,32,203,165  :rem 247
49536 DATA 253,217,174,193,165,254
                                 :rem 165
49542 DATA 249,175,193,144,20,165:rem 110
49548 DATA 253,56,249,174,193,133:rem 120
49554 DATA 253,165,254,249,175,193
                                 :rem 171
49560 DATA 133,254,238,32,203,208 :rem 97
49566 DATA 224,173,32,203,32,185  :rem 52
49572 DATA 193,169,0,141,32,203  :rem 254
49578 DATA 136,136,16,209,96,1   :rem 221
49584 DATA 0,10,0,100,0,232       :rem 29
49590 DATA 3,16,39,238,249,207   :rem 220
49596 DATA 174,249,207,9,48,157   :rem 29
49602 DATA 208,6,96,160,0,169    :rem 161
49608 DATA 0,133,251,169,64,133    :rem 1
49614 DATA 252,162,40,169,32,145  :rem 51
49620 DATA 251,200,208,249,230,252
                                 :rem 140
49626 DATA 202,208,244,96,160,0  :rem 255
49632 DATA 169,0,133,251,169,64    :rem 7
49638 DATA 133,252,169,0,145,251  :rem 54
49644 DATA 32,121,194,200,192,16  :rem 45
49650 DATA 208,246,169,0,133,251  :rem 51
49656 DATA 169,86,133,252,145,251:rem 116
49662 DATA 32,121,194,200,192,27  :rem 47
49668 DATA 208,246,169,0,145,251  :rem 63
49674 DATA 32,121,194,200,208,66  :rem 51
49680 DATA 230,252,232,224,2,208  :rem 42
49686 DATA 59,169,1,141,2,68     :rem 124
49692 DATA 169,2,141,3,68,169    :rem 173
49698 DATA 3,141,2,70,169,4       :rem 64
49704 DATA 141,3,70,169,32,141   :rem 201
49710 DATA 0,68,141,1,68,141     :rem 100
49716 DATA 0,70,141,0,66,141      :rem 96
49722 DATA 1,66,141,2,66,141     :rem 101
49728 DATA 1,70,141,3,66,160     :rem 104
49734 DATA 16,169,5,153,0,86     :rem 116
49740 DATA 200,192,22,208,248,96  :rem 55
49746 DATA 173,27,212,201,85,144  :rem 54
49752 DATA 173,201,160,176,14,165:rem 101
49758 DATA 252,201,72,144,163,56  :rem 58
49764 DATA 233,2,133,252,76,6    :rem 161
49770 DATA 194,165,252,201,96,176:rem 116
49776 DATA 149,24,105,2,133,252    :rem 3
49782 DATA 76,6,194,165,252,72   :rem 227
49788 DATA 169,0,145,251,230,252  :rem 58
49794 DATA 230,252,165,252,201,136
                                 :rem 151
49800 DATA 144,242,104,133,252,96 :rem 96
49806 DATA 169,4,141,60,3,169    :rem 164
49812 DATA 64,141,61,3,169,147   :rem 212
49818 DATA 32,210,255,160,255,169:rem 107
49824 DATA 14,153,255,215,153,254:rem 103
49830 DATA 216,153,253,217,153,252
                                 :rem 150
49836 DATA 218,136,208,241,169,1  :rem 59
49842 DATA 141,33,208,162,24,169  :rem 54
49848 DATA 0,157,0,212,202,16    :rem 148
49854 DATA 250,169,129,141,18,212:rem 107
49860 DATA 169,200,141,15,212,169:rem 100
49866 DATA 15,141,24,212,160,4   :rem 201
49872 DATA 162,21,24,32,240,255  :rem 253
49878 DATA 160,198,169,152,32,30  :rem 67
49884 DATA 171,160,20,162,21,24  :rem 251
49890 DATA 32,240,255,160,198,169:rem 116
49896 DATA 160,32,30,171,160,12  :rem 252
49902 DATA 162,23,24,32,240,255  :rem 249
49908 DATA 160,199,169,70,32,30   :rem 13
49914 DATA 171,169,129,141,26,208:rem 110
49920 DATA 169,127,141,13,220,169:rem 102
49926 DATA 0,141,40,208,141,41   :rem 195
49932 DATA 208,141,42,208,141,45  :rem 48
49938 DATA 208,141,44,208,141,43  :rem 54
49944 DATA 208,169,11,141,46,208  :rem 58
49950 DATA 169,251,141,255,7,141  :rem 56
49956 DATA 254,7,141,253,7,141   :rem 214
49962 DATA 252,7,169,33,141,4    :rem 164
49968 DATA 212,169,208,133,106,169
                                 :rem 167
49974 DATA 7,133,107,169,0,133   :rem 212
49980 DATA 108,169,16,141,5,212    :rem 4
49986 DATA 169,240,141,6,212,169  :rem 65
49992 DATA 15,141,24,212,162,2   :rem 201
49998 DATA 169,253,157,52,3,169   :rem 30
50004 DATA 252,157,55,3,202,16   :rem 189
50010 DATA 243,169,0,141,18,208  :rem 238
50016 DATA 173,17,208,41,127,141  :rem 36
50022 DATA 17,208,160,7,169,0    :rem 143
50028 DATA 153,0,57,136,16,250   :rem 194
50034 DATA 160,47,185,104,198,153 :rem 98
50040 DATA 0,56,136,16,247,169   :rem 200
50046 DATA 2,141,35,208,169,0    :rem 143
50052 DATA 141,34,208,133,2,169  :rem 242
50058 DATA 200,141,167,2,169,0   :rem 192
50064 DATA 141,168,2,141,169,2   :rem 196
50070 DATA 96,120,169,123,141,20  :rem 34
50076 DATA 3,169,199,141,21,3    :rem 154
50082 DATA 88,96,173,60,3,141    :rem 158
50088 DATA 201,195,173,61,3,141  :rem 248
50094 DATA 202,195,169,0,141,204  :rem 39
50100 DATA 195,169,4,141,205,195  :rem 43
50106 DATA 162,19,169,0,141,63   :rem 196
50112 DATA 3,173,17,208,16,251   :rem 190
50118 DATA 160,39,185,0,0,153    :rem 143
50124 DATA 0,0,136,16,247,173    :rem 139
50130 DATA 204,195,24,105,40,141  :rem 26
50136 DATA 204,195,173,205,195,105
                                 :rem 145
50142 DATA 0,141,205,195,238,202  :rem 31
50148 DATA 195,238,202,195,202,208
                                 :rem 149
50154 DATA 219,96,206,62,3,16    :rem 154
50160 DATA 50,238,60,3,208,3      :rem 90
50166 DATA 238,61,3,169,7,141    :rem 156
50172 DATA 62,3,32,164,195,76    :rem 156
50178 DATA 35,196,238,62,3,173   :rem 214
50184 DATA 62,3,201,8,208,21      :rem 91
50190 DATA 206,60,3,173,60,3      :rem 90
50196 DATA 201,255,208,3,206,61  :rem 246
```

"A LIVING TAPESTRY . . ."



"The world of Ultima III can only be compared to a living tapestry — complex and beautiful . . . This is the best fantasy game in computing. Indeed, it is one of the best fantasy worlds in which to live. Lord British is a veritable JRR Tolkien of the keyboard." — Popular Mechanics

"Exodus: Ultima III, with a superior plot to match its superior gaming system, is a great game. It upgrades the market; in several ways it sets new standards for fantasy gaming state of the art." — Softline

"Exodus: Ultima III is Lord British's magnum opus — so far. It's fun and exciting to play and constantly intriguing. And the ending is marvelously unexpected and not a bit disappointing — except that it is the ending, and as with a good book, you'll probably wish there were more." — Softalk

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```
50202 DATA 3,169,0,141,62,3          :rem 35
50208 DATA 32,164,195,32,46,196       :rem 3
50214 DATA 96,133,38,134,39,132     :rem 253
50220 DATA 40,96,165,38,166,39      :rem 210
50226 DATA 164,40,96,174,0,208      :rem 201
50232 DATA 172,1,208,169,0,133      :rem 190
50238 DATA 251,173,0,220,74,176     :rem 248
50244 DATA 5,192,47,144,1,136       :rem 149
50250 DATA 74,176,5,192,175,176       :rem 7
50256 DATA 1,200,74,176,21,72       :rem 144
50262 DATA 169,255,141,248,7,104     :rem 49
50268 DATA 224,107,208,9,32,39      :rem 207
50274 DATA 196,32,4,196,76,106      :rem 213
50280 DATA 196,202,74,176,21,72     :rem 254
50286 DATA 169,254,141,248,7,104     :rem 54
50292 DATA 224,205,208,9,32,39      :rem 203
50298 DATA 196,32,236,195,76,130     :rem 62
50304 DATA 196,232,74,176,5,169       :rem 7
50310 DATA 1,141,128,3,142,0         :rem 75
50316 DATA 208,140,1,208,96,160     :rem 245
50322 DATA 255,185,231,196,153,127
                                    :rem 149
50328 DATA 62,185,104,197,153,0     :rem 253
50334 DATA 63,136,208,241,169,255:rem 101
50340 DATA 141,21,208,169,2,141     :rem 237
50346 DATA 39,208,169,254,141,248:rem 109
50352 DATA 7,169,118,141,1,208      :rem 199
50358 DATA 169,138,141,0,208,173     :rem 50
50364 DATA 22,208,41,247,141,22     :rem 242
50370 DATA 208,169,4,141,62,3       :rem 148
50376 DATA 169,0,141,63,3,169       :rem 157
50382 DATA 20,141,3,208,141,5       :rem 136
50388 DATA 208,141,7,208,169,80       :rem 7
50394 DATA 141,2,208,169,160,141     :rem 42
50400 DATA 4,208,169,240,141,6      :rem 191
50406 DATA 208,96,144,0,2,64         :rem 99
50412 DATA 0,16,184,0,38,20          :rem 35
50418 DATA 0,0,41,16,36,4           :rem 193
50424 DATA 68,80,2,130,36,1          :rem 43
50430 DATA 64,168,0,176,0,1          :rem 42
50436 DATA 52,64,0,240,16,95        :rem 100
50442 DATA 104,208,196,0,128,73     :rem 249
50448 DATA 128,0,166,34,160,141     :rem 247
50454 DATA 72,32,1,34,74,0          :rem 249
50460 DATA 202,41,0,0,160,0          :rem 21
50466 DATA 0,2,0,0,18,0              :rem 86
50472 DATA 0,0,0,0,0,0               :rem 24
50478 DATA 0,0,0,0,0,0               :rem 30
50484 DATA 0,0,0,0,0,0               :rem 27
50490 DATA 0,0,0,0,0,0               :rem 24
50496 DATA 0,0,0,2,34,0              :rem 87
50502 DATA 5,85,64,0,136,128         :rem 99
50508 DATA 0,0,0,0,0,0               :rem 24
50514 DATA 0,0,0,0,0,0               :rem 21
50520 DATA 0,0,0,0,0,0               :rem 18
50526 DATA 0,0,0,0,0,0               :rem 24
50532 DATA 0,0,0,0,0,0               :rem 21
50538 DATA 0,0,0,0,0,60              :rem 81
50544 DATA 0,0,66,0,0,66            :rem 144
50550 DATA 0,0,90,0,3,195           :rem 192
50556 DATA 192,12,66,48,16,66       :rem 165
50562 DATA 8,32,66,4,73,165          :rem 59
50568 DATA 146,146,36,73,164,24       :rem 8
50574 DATA 37,168,189,21,168,195     :rem 71
50580 DATA 21,81,0,138,2,0          :rem 242
50586 DATA 64,2,0,64,5,0            :rem 153
50592 DATA 160,0,0,0,0,0            :rem 130
50598 DATA 0,255,0,0,0,0            :rem 141
50604 DATA 0,0,0,60,0,0              :rem 75
50610 DATA 66,0,128,66,1,126         :rem 95
50616 DATA 90,126,33,195,132,192     :rem 49
50622 DATA 66,3,32,66,4,32          :rem 254
50628 DATA 66,4,80,36,10,24          :rem 51
50634 DATA 36,24,20,24,40,3          :rem 38
50640 DATA 189,192,0,195,0,1         :rem 99
50646 DATA 0,128,2,0,64,2           :rem 196
50652 DATA 0,64,5,0,160,0           :rem 190
50658 DATA 0,0,0,0,0,255            :rem 138
50664 DATA 0,0,0,0,0,0               :rem 27
50670 DATA 0,0,0,15,128,0           :rem 185
50676 DATA 31,192,0,31,192,0         :rem 94
50682 DATA 31,224,0,15,240,0         :rem 83
50688 DATA 3,224,96,3,224,127       :rem 160
50694 DATA 3,255,195,3,255,252      :rem 212
50700 DATA 3,224,0,3,224,0          :rem 232
50706 DATA 3,224,0,59,255,156       :rem 153
50712 DATA 67,255,130,131,255,129 :rem 95
50718 DATA 71,24,226,56,231,28      :rem 206
50724 DATA 0,0,0,184,0,0            :rem 133
50730 DATA 0,0,0,0,0,0               :rem 21
50736 DATA 0,0,1,240,0,3            :rem 133
50742 DATA 248,0,3,248,0,7          :rem 254
50748 DATA 248,0,15,240,6,7          :rem 53
50754 DATA 192,254,7,192,195,255     :rem 64
50760 DATA 192,63,255,192,0,7       :rem 156
50766 DATA 192,0,7,192,0,7            :rem 4
50772 DATA 192,57,255,220,65,255     :rem 58
50778 DATA 194,129,255,193,71,24     :rem 66
50784 DATA 226,56,231,28,0,0         :rem 99
50790 DATA 0,184,85,105,105,85      :rem 206
50796 DATA 85,105,105,85,5,22       :rem 160
50802 DATA 22,7,15,63,62,59          :rem 53
50808 DATA 80,148,148,208,240,252:rem 102
50814 DATA 188,236,15,15,15,63      :rem 207
50820 DATA 63,63,255,255,240,240     :rem 43
50826 DATA 240,252,252,252,255,255
                                    :rem 148
50832 DATA 255,255,255,255,255,255
                                    :rem 160
50838 DATA 255,255,144,83,67,79      :rem 23
50844 DATA 82,69,58,0,144,77        :rem 120
50850 DATA 65,71,73,67,58,0          :rem 63
50856 DATA 158,89,79,85,32,83       :rem 186
50862 DATA 65,86,69,68,32,84        :rem 130
50868 DATA 72,69,32,80,82,73        :rem 122
50874 DATA 78,67,69,83,83,32        :rem 132
50880 DATA 33,0,28,66,79,78          :rem 70
50886 DATA 85,83,17,17,157,157      :rem 227
50892 DATA 157,157,157,83,67,79      :rem 29
50898 DATA 82,69,17,17,157,157      :rem 231
50904 DATA 157,157,72,73,84,32      :rem 214
50910 DATA 65,78,89,32,75,69        :rem 128
50916 DATA 89,0,28,78,85,77          :rem 80
50922 DATA 66,69,82,32,79,70        :rem 121
50928 DATA 32,66,73,82,68,83        :rem 124
50934 DATA 32,40,49,45,51,41        :rem 101
50940 DATA 32,79,82,32,81,32        :rem 106
50946 DATA 84,79,32,81,85,73        :rem 127
50952 DATA 84,0,158,80,79,79        :rem 125
50958 DATA 82,32,80,82,73,78        :rem 123
50964 DATA 67,69,83,83,32,66        :rem 129
50970 DATA 76,79,78,68,69,76        :rem 145
50976 DATA 76,0,7,12,120,7             :rem 2
50982 DATA 233,120,8,97,240,7       :rem 158
50988 DATA 233,240,7,12,240,7       :rem 153
50994 DATA 12,120,7,233,120,8       :rem 145
51000 DATA 97,120,10,143,120,7      :rem 178
51006 DATA 233,120,8,97,120,7       :rem 143
51012 DATA 12,240,28,66,79,78       :rem 157
51018 DATA 85,83,58,0,162,3          :rem 54
51024 DATA 160,255,136,208,253,202
                                    :rem 135
51030 DATA 208,248,165,108,208,30 :rem 89
51036 DATA 198,109,208,26,169,20  :rem 53
```

IF THIS IS YOUR IDEA OF A FLEA FLICKER ON A RED DOG,
FLIK
YOU'RE BARKING UP THE WRONG TREE.

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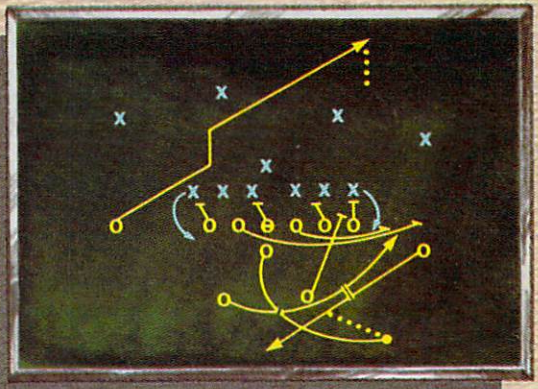

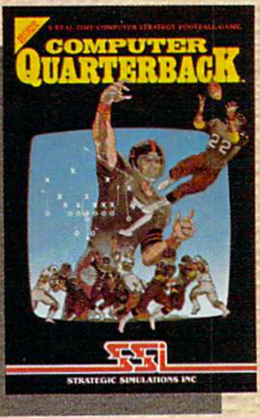
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COMPUTER QUARTERBACK
SSI
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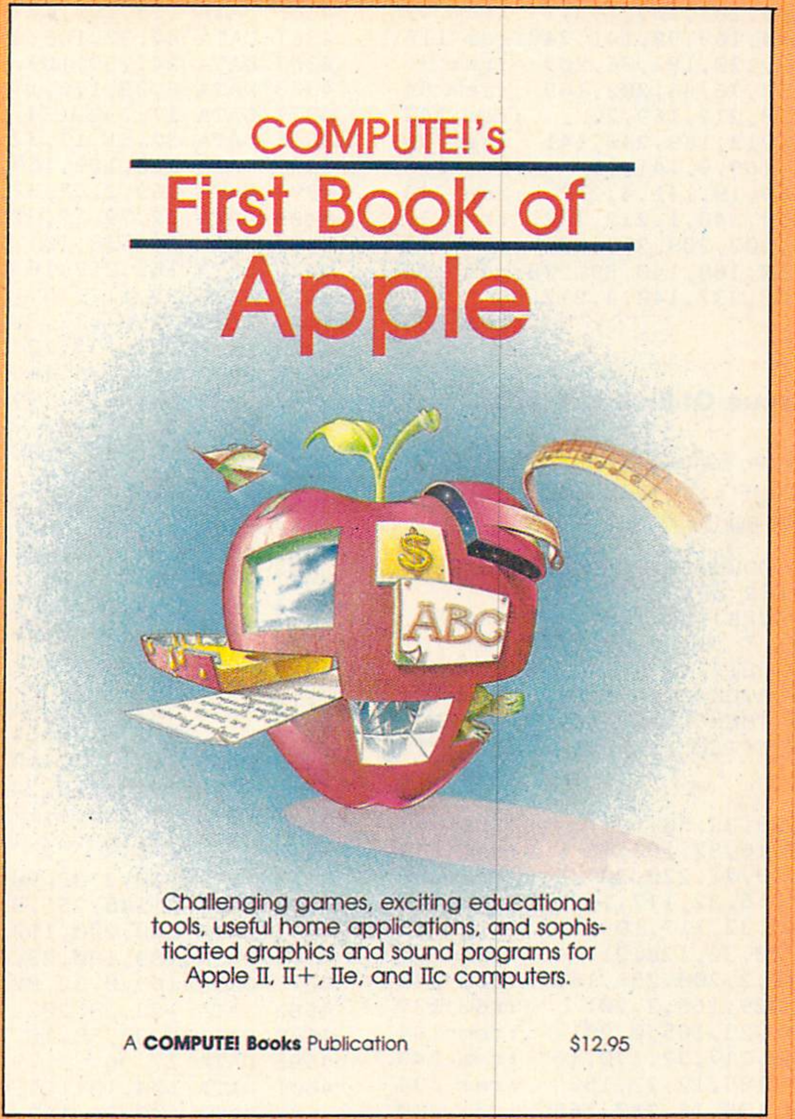
```
51042 DATA 133,109,198,106,165,106
                                  :rem 143
51048 DATA 201,255,208,14,198,107 :rem 96
51054 DATA 16,10,169,1,133,108    :rem 190
51060 DATA 169,0,133,106,133,107  :rem 31
51066 DATA 96,169,1,141,25,208    :rem 207
51072 DATA 173,18,208,201,204,144 :rem 85
51078 DATA 36,173,22,208,41,248    :rem 0
51084 DATA 9,0,141,22,208,173     :rem 144
51090 DATA 24,208,41,240,9,5       :rem 94
51096 DATA 141,24,208,173,22,208   :rem 42
51102 DATA 41,239,141,22,208,169   :rem 38
51108 DATA 0,141,18,208,76,205    :rem 194
51114 DATA 199,173,22,208,41,240   :rem 41
51120 DATA 13,62,3,141,22,208     :rem 130
51126 DATA 169,205,141,18,208,173 :rem 96
51132 DATA 24,208,41,240,9,14     :rem 139
51138 DATA 141,24,208,173,22,208   :rem 39
51144 DATA 9,16,141,22,208,173    :rem 196
51150 DATA 13,220,41,1,240,76     :rem 131
51156 DATA 206,133,3,208,68,169     :rem 2
51162 DATA 5,141,133,3,173,132    :rem 187
51168 DATA 3,208,30,169,1,141     :rem 146
51174 DATA 132,3,173,52,3,141     :rem 140
51180 DATA 249,7,173,53,3,141     :rem 151
51186 DATA 250,7,173,54,3,141     :rem 150
51192 DATA 251,7,169,129,141,11   :rem 251
51198 DATA 212,208,28,173,55,3    :rem 207
51204 DATA 141,249,7,173,56,3     :rem 151
51210 DATA 141,250,7,173,57,3     :rem 141
51216 DATA 141,251,7,169,128,141   :rem 43
51222 DATA 11,212,169,0,141,132   :rem 229
51228 DATA 3,76,49,234,76,188     :rem 172
51234 DATA 254,162,0,138,74,168   :rem 255
51240 DATA 185,249,7,201,250,240   :rem 38
51246 DATA 117,173,27,212,201,75   :rem 41
51252 DATA 144,43,201,105,176,6   :rem 242
51258 DATA 222,2,208,76,152,200   :rem 244
51264 DATA 201,150,176,13,189,2   :rem 247
51270 DATA 208,201,200,240,77,254 :rem 83
51276 DATA 2,208,76,152,200,201   :rem 241
51282 DATA 190,176,6,222,3,208    :rem 201
51288 DATA 76,152,200,254,3,208   :rem 253
51294 DATA 76,152,200,189,2,208     :rem 0
51300 DATA 205,0,208,240,28,144   :rem 233
51306 DATA 11,222,2,208,169,1     :rem 138
51312 DATA 157,176,2,76,133,200   :rem 245
51318 DATA 189,2,208,201,255,240   :rem 43
51324 DATA 27,254,2,208,169,0     :rem 149
51330 DATA 157,176,2,189,3,208    :rem 206
51336 DATA 205,1,208,240,18,144   :rem 242
51342 DATA 6,222,3,208,76,152     :rem 147
51348 DATA 200,254,3,208,173,27   :rem 249
51354 DATA 212,201,2,176,5,169    :rem 197
51360 DATA 1,157,80,3,232,232     :rem 140
51366 DATA 228,21,240,3,76,37     :rem 154
51372 DATA 200,96,162,0,189,192     :rem 0
51378 DATA 2,208,68,189,80,3      :rem 117
51384 DATA 208,3,76,38,201,189    :rem 213
51390 DATA 176,2,157,224,2,240    :rem 197
51396 DATA 12,189,2,208,56,233    :rem 210
51402 DATA 20,157,8,208,76,218    :rem 203
51408 DATA 200,189,2,208,24,105   :rem 244
51414 DATA 20,157,8,208,32,45     :rem 148
51420 DATA 201,141,255,2,173,21   :rem 231
51426 DATA 208,13,255,2,141,21    :rem 189
51432 DATA 208,189,3,208,157,9    :rem 212
51438 DATA 208,169,1,157,192,2    :rem 209
51444 DATA 169,56,157,240,2,189    :rem 10
51450 DATA 224,2,240,6,222,8       :rem 89
51456 DATA 208,76,7,201,254,8     :rem 159
51462 DATA 208,222,240,2,208,26   :rem 242
```

```
51468 DATA 169,0,157,192,2,157    :rem 214
51474 DATA 80,3,32,45,201,24       :rem 93
51480 DATA 105,255,141,255,2,173   :rem 41
51486 DATA 21,208,45,255,2,141    :rem 200
51492 DATA 21,208,232,232,228,21   :rem 37
51498 DATA 208,132,96,138,74,168   :rem 70
51504 DATA 169,16,192,0,208,1     :rem 147
51510 DATA 96,10,136,76,50,201    :rem 193
51516 DATA 173,129,3,208,77,173     :rem 5
51522 DATA 128,3,208,1,96,169     :rem 157
51528 DATA 1,141,129,3,173,21     :rem 143
51534 DATA 208,9,128,141,21,208   :rem 249
51540 DATA 169,129,141,4,212,169   :rem 48
51546 DATA 0,141,16,208,169,85    :rem 207
51552 DATA 141,131,3,173,1,208    :rem 188
51558 DATA 141,15,208,173,248,7     :rem 4
51564 DATA 201,255,208,15,169,1   :rem 251
51570 DATA 141,130,3,173,0,208    :rem 186
51576 DATA 56,233,19,141,14,208     :rem 0
51582 DATA 96,169,0,141,130,3     :rem 151
51588 DATA 173,0,208,24,105,19    :rem 204
51594 DATA 141,14,208,96,173,130   :rem 49
51600 DATA 3,208,26,238,14,208    :rem 195
51606 DATA 173,14,208,201,255,208 :rem 91
51612 DATA 19,173,16,208,9,128    :rem 207
51618 DATA 141,16,208,169,0,141   :rem 248
51624 DATA 14,208,76,176,201,206   :rem 45
51630 DATA 14,208,206,131,3,173   :rem 239
51636 DATA 131,3,141,1,212,208    :rem 185
51642 DATA 21,173,21,208,41,127   :rem 242
51648 DATA 141,21,208,169,0,141   :rem 247
51654 DATA 129,3,141,128,3,169    :rem 206
51660 DATA 128,141,4,212,96,169     :rem 1
51666 DATA 0,141,13,212,141,12    :rem 182
51672 DATA 212,141,8,212,160,0    :rem 186
51678 DATA 185,34,199,141,1,212     :rem 5
51684 DATA 185,35,199,141,0,212     :rem 2
51690 DATA 190,36,199,169,255,133:rem 116
51696 DATA 41,198,41,208,252,202   :rem 52
51702 DATA 208,245,200,200,200,192
                                  :rem 124
51708 DATA 36,144,223,169,32,141   :rem 47
51714 DATA 4,212,169,114,141,13   :rem 241
51720 DATA 212,169,17,141,12,212   :rem 32
51726 DATA 141,8,212,96,120,169     :rem 0
51732 DATA 49,141,20,3,169,234    :rem 201
51738 DATA 141,21,3,169,0,141     :rem 144
51744 DATA 26,208,169,255,141,13   :rem 51
51750 DATA 220,169,0,141,21,208   :rem 239
51756 DATA 88,96,32,91,255,162    :rem 225
51762 DATA 10,160,3,24,32,240     :rem 135
51768 DATA 255,169,230,160,198,32:rem 112
51774 DATA 30,171,169,1,141,33    :rem 199
51780 DATA 208,165,203,201,62,208 :rem 91
51786 DATA 1,0,201,56,208,4        :rem 46
51792 DATA 162,1,208,14,201,59    :rem 200
51798 DATA 208,4,162,2,208,6      :rem 109
51804 DATA 201,8,208,229,162,3    :rem 198
51810 DATA 134,20,138,10,133,21   :rem 230
51816 DATA 76,3,192,169,0,141     :rem 157
51822 DATA 24,212,32,18,202,173   :rem 240
51828 DATA 24,208,41,240,9,5      :rem 103
51834 DATA 141,24,208,169,147,32   :rem 50
51840 DATA 210,255,162,10,160,8   :rem 240
51846 DATA 24,32,240,255,165,113   :rem 44
51852 DATA 164,114,32,30,171,165   :rem 41
51858 DATA 106,133,253,165,107,133
                                  :rem 148
51864 DATA 254,169,19,141,249,207:rem 113
51870 DATA 32,120,193,162,18,160   :rem 41
51876 DATA 12,24,32,240,255,169     :rem 1
51882 DATA 194,160,198,32,30,171   :rem 54
```



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```
51888 DATA 169,0,141,33,208,165     :rem 6
51894 DATA 106,24,109,168,2,133     :rem 0
51900 DATA 253,165,107,109,169,2   :rem 47
51906 DATA 133,254,169,99,141,249:rem 116
51912 DATA 207,32,120,193,36,203   :rem 36
51918 DATA 112,252,76,46,202,169   :rem 54
51924 DATA 8,141,3,212,169,20     :rem 147
51930 DATA 141,5,212,169,240,141   :rem 36
51936 DATA 6,212,169,9,141,15     :rem 158
51942 DATA 212,169,19,141,4,212   :rem 249
51948 DATA 160,255,140,1,212,152   :rem 39
51954 DATA 160,3,202,208,253,136   :rem 42
51960 DATA 208,250,168,140,39,208:rem 102
51966 DATA 136,208,237,140,4,212,96
                                  :rem 202
```

Program 3: Rescue Of Blondell, VIC Version

Version by Kevin Mykytyn, Editorial Programmer

Please refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 PRINT"{CLR}{4 DOWN}{RVS}{2 SPACES}RESC
   UE OF BLONDELL{2 SPACES}":PRINT"
   {2 DOWN}{2 SPACES}{BLK}{RVS} ENTERING
   {SPACE}ML DATA "                :rem 161
20 FOR I=4109 TO 5812               :rem 16
30 READ A:POKE I,A:CK=CK+A:NEXT     :rem 87
40 IF CK<>176773 THEN PRINT"{3 DOWN}{BLU}
   {RVS}ERROR DETECTED IN DATA STATEMENTS
   ":STOP                          :rem 163
50 SYS 4109                         :rem 50
4109 DATA 32,12,19,32,58,18         :rem 49
4115 DATA 32,127,16,32,150,18      :rem 139
4121 DATA 32,68,19,32,222,20        :rem 88
4127 DATA 32,181,16,32,117,19      :rem 146
4133 DATA 32,3,19,32,117,19         :rem 43
4139 DATA 32,19,20,32,128,21        :rem 91
4145 DATA 173,141,2,208,251,165    :rem 245
4151 DATA 4,240,229,165,2,201      :rem 137
4157 DATA 10,208,223,165,0,201     :rem 184
4163 DATA 229,208,217,32,170,16    :rem 249
4169 DATA 160,21,185,12,22,153     :rem 194
4175 DATA 132,30,136,16,247,165    :rem 250
4181 DATA 65,24,101,63,133,65      :rem 146
4187 DATA 165,66,101,64,133,66     :rem 209
4193 DATA 32,68,19,160,10,185      :rem 154
4199 DATA 56,22,153,181,30,136     :rem 204
4205 DATA 16,247,32,128,21,165     :rem 196
4211 DATA 203,201,11,240,149,201    :rem 15
4217 DATA 28,208,246,76,34,253     :rem 210
4223 DATA 169,147,32,210,255,32    :rem 246
4229 DATA 68,19,160,18,185,67      :rem 170
4235 DATA 22,153,222,30,136,16     :rem 187
4241 DATA 247,32,249,253,164,203    :rem 44
4247 DATA 185,94,236,201,49,144      :rem 6
4253 DATA 247,201,58,176,243,56      :rem 3
4259 DATA 233,48,10,141,72,3        :rem 97
4265 DATA 96,169,32,160,0,153      :rem 155
4271 DATA 0,30,136,208,250,96      :rem 145
4277 DATA 166,1,164,2,32,51         :rem 48
4283 DATA 17,32,95,17,169,0         :rem 58
4289 DATA 141,19,145,173,17,145      :rem 4
4295 DATA 74,74,74,176,5,192       :rem 122
4301 DATA 2,144,1,136,74,72         :rem 40
4307 DATA 176,19,200,192,19,208    :rem 254
4313 DATA 14,136,165,3,208,9        :rem 98
4319 DATA 169,1,133,3,169,36       :rem 107
4325 DATA 141,154,31,104,74,72     :rem 193
4331 DATA 176,15,169,33,133,109    :rem 252
4337 DATA 224,7,176,6,32,245       :rem 106
4343 DATA 17,76,252,16,202,104     :rem 194
4349 DATA 74,176,4,169,1,133       :rem 111
4355 DATA 113,169,127,141,34,145    :rem 45
4361 DATA 44,32,145,48,15,169      :rem 157
4367 DATA 34,133,109,224,15,144    :rem 249
4373 DATA 6,32,176,17,76,29         :rem 64
4379 DATA 17,232,134,1,132,2        :rem 93
4385 DATA 32,51,17,32,95,17         :rem 56
4391 DATA 165,109,160,0,145,251    :rem 246
4397 DATA 169,2,32,82,19,96         :rem 71
4403 DATA 32,79,17,32,104,18        :rem 97
4409 DATA 24,138,101,251,133,251    :rem 34
4415 DATA 165,252,105,0,133,252    :rem 239
4421 DATA 32,122,18,136,208,250    :rem 239
4427 DATA 32,87,17,96,120,133      :rem 156
4433 DATA 105,134,106,132,107,96    :rem 38
4439 DATA 165,105,166,106,164,107 :rem 99
4445 DATA 88,96,32,79,17,160       :rem 122
4451 DATA 0,177,251,240,20,201     :rem 182
4457 DATA 38,240,8,201,36,208      :rem 153
4463 DATA 56,169,1,133,4,198       :rem 112
4469 DATA 69,165,69,201,0,208      :rem 164
4475 DATA 44,169,15,141,14,144     :rem 204
4481 DATA 169,39,145,251,32,82     :rem 212
4487 DATA 19,88,165,162,105,100      :rem 3
4493 DATA 197,162,208,252,32,170    :rem 52
4499 DATA 16,169,0,160,21,133      :rem 152
4505 DATA 63,133,64,185,34,22      :rem 151
4511 DATA 153,132,30,136,16,247    :rem 241
4517 DATA 76,97,16,169,32,145      :rem 170
4523 DATA 251,32,87,17,96,32       :rem 108
4529 DATA 79,17,32,104,18,165      :rem 161
4535 DATA 0,201,10,240,56,162      :rem 133
4541 DATA 19,160,1,177,251,208     :rem 199
4547 DATA 18,169,32,145,251,136      :rem 4

4553 DATA 208,3,32,98,19,169       :rem 116
4559 DATA 0,145,251,32,82,19       :rem 104
4565 DATA 200,200,192,22,208,229    :rem 37
4571 DATA 189,180,23,136,145,251    :rem 51
4577 DATA 169,0,32,82,19,32         :rem 59
4583 DATA 122,18,202,208,210,198    :rem 43
4589 DATA 0,32,58,18,32,87          :rem 15
4595 DATA 17,96,32,79,17,32         :rem 70
4601 DATA 104,18,165,0,201,229     :rem 187
4607 DATA 240,56,162,19,160,20     :rem 196
4613 DATA 177,251,208,20,169,32    :rem 252
4619 DATA 145,251,200,192,21,208    :rem 39
4625 DATA 3,32,98,19,169,0          :rem 10
4631 DATA 145,251,32,82,19,136     :rem 201
4637 DATA 136,16,229,189,200,23      :rem 1
4643 DATA 200,145,251,169,0,32     :rem 192
4649 DATA 82,19,32,122,18,202      :rem 152
4655 DATA 208,210,230,0,32,58      :rem 142
4661 DATA 18,32,87,17,96,169       :rem 123
4667 DATA 32,160,19,153,180,23     :rem 202
4673 DATA 153,200,23,136,16,247    :rem 248
4679 DATA 164,0,192,17,240,12      :rem 152
4685 DATA 185,181,22,168,169,0     :rem 216
4691 DATA 153,180,23,136,16,250    :rem 249
4697 DATA 164,0,185,202,22,168     :rem 208
4703 DATA 169,0,153,200,23,136     :rem 190
4709 DATA 16,250,96,169,0,133      :rem 158
4715 DATA 251,169,30,133,252,169    :rem 50
4721 DATA 0,133,110,173,3,144      :rem 132
4727 DATA 16,251,96,165,251,24     :rem 210
4733 DATA 105,22,133,251,165,252    :rem 37
4739 DATA 105,0,133,252,96,165     :rem 206
4745 DATA 251,56,233,22,133,251    :rem 248
4751 DATA 165,252,233,0,133,252    :rem 244
4757 DATA 96,169,10,133,2,169      :rem 166
4763 DATA 7,133,1,169,147,32       :rem 106
4769 DATA 210,255,169,0,133,113    :rem 251
```

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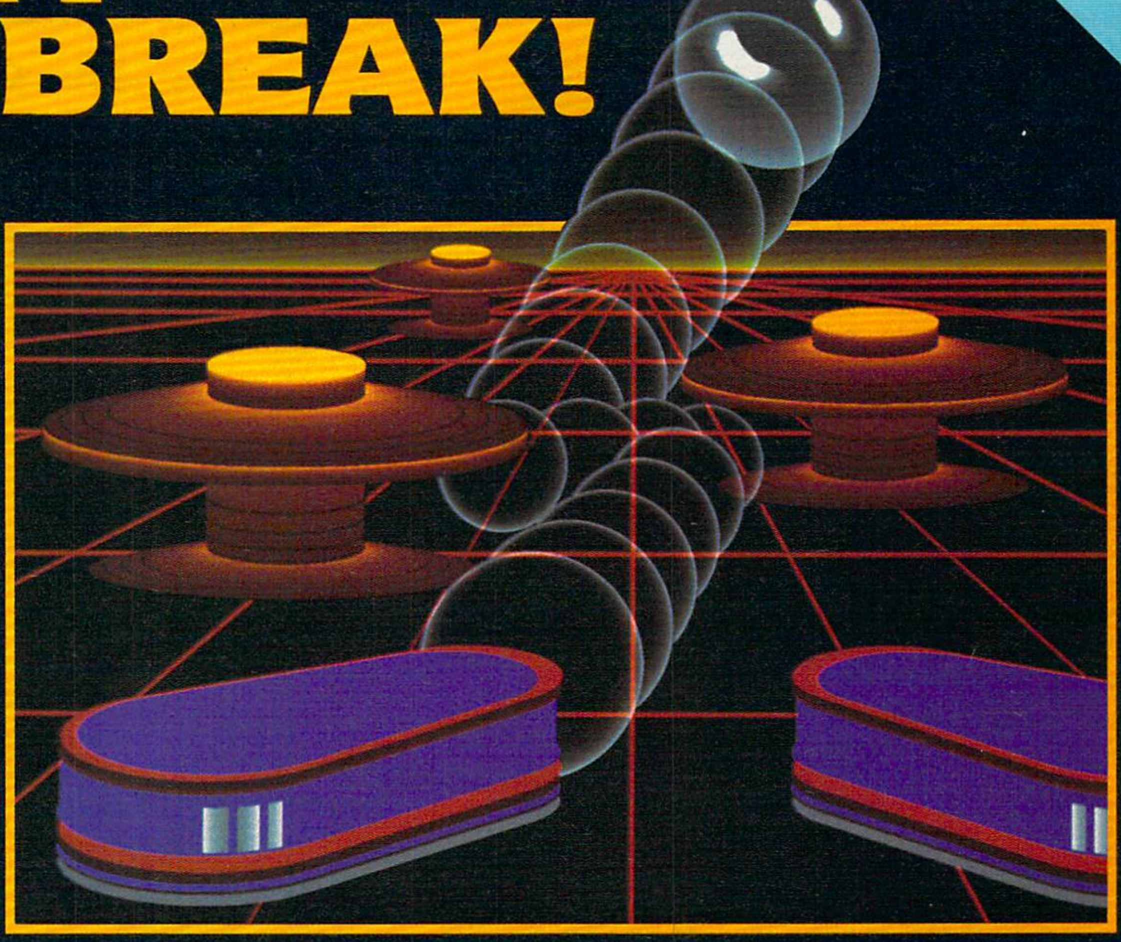

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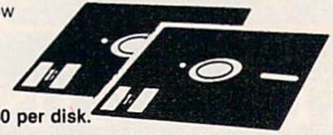

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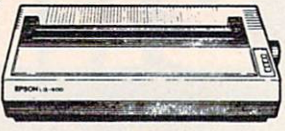

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```
4775 DATA 133,114,133,3,133,4    :rem 143
4781 DATA 168,153,220,23,136,208  :rem 47
4787 DATA 250,169,34,133,109,133  :rem 54
4793 DATA 116,160,22,32,176,17   :rem 203
4799 DATA 136,16,250,160,0,185   :rem 208
4805 DATA 0,128,153,0,28,185      :rem 99
4811 DATA 0,129,153,0,29,136      :rem 94
4817 DATA 208,241,169,255,141,5    :rem 2
4823 DATA 144,160,79,185,101,22  :rem 251
4829 DATA 153,8,29,136,16,247    :rem 167
4835 DATA 160,7,185,173,22,153   :rem 206
4841 DATA 0,28,136,16,247,169    :rem 159
4847 DATA 232,133,63,169,3,133   :rem 206
4853 DATA 64,169,0,133,65,133    :rem 157
4859 DATA 66,133,70,169,25,133   :rem 216
4865 DATA 69,96,165,162,105,5    :rem 171
4871 DATA 197,162,208,252,96,160  :rem 61
4877 DATA 12,169,8,153,167,23    :rem 167
4883 DATA 136,16,250,160,242,162  :rem 45
4889 DATA 9,138,153,181,22,32    :rem 164
4895 DATA 58,19,201,150,176,8    :rem 166
4901 DATA 224,3,144,9,202,76      :rem 98
4907 DATA 50,19,224,16,176,1     :rem 103
4913 DATA 232,136,208,229,169,252:rem 104
4919 DATA 133,0,96,165,108,10    :rem 153
4925 DATA 10,56,101,108,133,108  :rem 241
4931 DATA 96,169,0,160,0,153     :rem 102
4937 DATA 0,150,153,0,151,136    :rem 141
4943 DATA 208,247,96,72,165,251   :rem 13
4949 DATA 133,43,165,252,24,105  :rem 255
4955 DATA 120,133,44,104,145,43  :rem 245
4961 DATA 96,165,110,208,14,32   :rem 203
4967 DATA 136,18,169,32,145,251   :rem 10
4973 DATA 32,122,18,169,1,133    :rem 152
4979 DATA 110,96,165,114,208,44    :rem 8
4985 DATA 165,113,240,39,165,251  :rem 55

4991 DATA 133,253,165,252,133,254:rem 101
4997 DATA 169,1,133,115,169,15   :rem 216
5003 DATA 141,14,144,165,109,201  :rem 27
5009 DATA 33,208,6,169,1,133      :rem 98
5015 DATA 111,208,4,169,0,133    :rem 137
5021 DATA 111,169,7,133,112,133  :rem 234
5027 DATA 114,96,177,253,240,99   :rem 10
5033 DATA 165,115,208,6,160,0    :rem 139
5039 DATA 169,32,145,253,169,0   :rem 208
5045 DATA 133,115,165,111,208,9  :rem 244
5051 DATA 230,253,208,2,230,254  :rem 236
5057 DATA 76,206,19,198,253,165   :rem 14
5063 DATA 253,201,255,208,2,198  :rem 251
5069 DATA 254,165,253,133,251,165:rem 102
5075 DATA 254,133,252,198,112,165:rem 100
5081 DATA 112,240,48,10,10,10    :rem 125
5087 DATA 10,24,105,158,141,13   :rem 191
5093 DATA 144,177,253,240,34,201  :rem 41
5099 DATA 38,208,20,32,114,21    :rem 146
5105 DATA 169,39,145,253,169,7   :rem 216
5111 DATA 32,82,19,169,15,141    :rem 147
5117 DATA 14,144,76,12,20,169    :rem 148
5123 DATA 35,145,253,169,0,32    :rem 146
5129 DATA 82,19,96,169,0,133     :rem 113
5135 DATA 113,133,114,96,160,0   :rem 188
5141 DATA 132,25,185,220,23,170  :rem 237
5147 DATA 133,20,185,221,23,168  :rem 247
5153 DATA 133,21,132,26,32,51    :rem 135
5159 DATA 17,160,0,177,251,76    :rem 157
5165 DATA 120,20,169,32,145,251  :rem 243
5171 DATA 164,26,32,58,19,201    :rem 150
5177 DATA 215,144,114,228,1,240  :rem 244
5183 DATA 7,144,4,202,76,71       :rem 52
5189 DATA 20,232,196,2,240,7     :rem 101
5195 DATA 144,4,136,76,82,20     :rem 106
5201 DATA 200,132,26,32,51,17    :rem 129
```

```
5207 DATA 32,148,20,169,38,160   :rem 202
5213 DATA 0,145,251,169,6,32      :rem 94
5219 DATA 82,19,164,25,138,153   :rem 210
5225 DATA 220,23,165,26,153,221  :rem 239
5231 DATA 23,200,200,204,72,3    :rem 124
5237 DATA 208,158,96,201,38,240    :rem 2
5243 DATA 179,165,21,240,175,164  :rem 50
5249 DATA 25,32,58,19,74,74       :rem 67
5255 DATA 74,74,153,220,23,169   :rem 207
5261 DATA 0,153,221,23,76,112    :rem 136
5267 DATA 20,160,0,177,251,201   :rem 189
5273 DATA 32,240,17,201,33,240   :rem 185
5279 DATA 13,201,34,240,9,166    :rem 151
5285 DATA 20,164,21,132,26,32    :rem 141
5291 DATA 51,17,96,32,58,19       :rem 64
5297 DATA 201,60,176,8,224,20    :rem 150
5303 DATA 240,4,232,76,219,20    :rem 141
5309 DATA 201,120,176,8,224,0    :rem 139
5315 DATA 240,4,202,76,219,20    :rem 141
5321 DATA 201,180,176,5,192,1    :rem 141
5327 DATA 240,1,136,201,181,144  :rem 238
5333 DATA 5,192,20,240,1,200      :rem 80
5339 DATA 76,82,20,120,169,235   :rem 208
5345 DATA 141,20,3,169,20,141    :rem 138
5351 DATA 21,3,88,96,165,251     :rem 109
5357 DATA 72,165,252,72,198,116   :rem 11
5363 DATA 208,3,32,38,21,160      :rem 94
5369 DATA 7,165,116,201,10,144   :rem 197
5375 DATA 20,173,14,144,240,3    :rem 142
5381 DATA 206,14,144,185,141,22  :rem 245
5387 DATA 153,48,29,136,16,247   :rem 219
5393 DATA 76,29,21,185,133,22    :rem 158
5399 DATA 153,48,29,136,16,247   :rem 222
5405 DATA 104,133,252,104,133,251 :rem 77
5411 DATA 76,191,234,169,20,133  :rem 251

5417 DATA 116,32,104,18,162,19   :rem 197
5423 DATA 160,21,177,251,201,39  :rem 244
5429 DATA 144,27,201,42,176,23   :rem 200
5435 DATA 24,105,1,72,169,130    :rem 145
5441 DATA 141,13,144,104,201,42  :rem 229
5447 DATA 208,2,169,32,145,251   :rem 205
5453 DATA 169,7,32,82,19,136     :rem 113
5459 DATA 16,220,32,122,18,202   :rem 191
5465 DATA 16,212,198,63,165,63   :rem 214
5471 DATA 201,255,208,14,198,64    :rem 1
5477 DATA 165,64,201,255,208,6   :rem 210
5483 DATA 169,0,133,63,133,64    :rem 155
5489 DATA 96,165,65,24,105,10    :rem 163
5495 DATA 133,65,165,66,105,0    :rem 157
5501 DATA 133,66,96,165,65,133   :rem 209
5507 DATA 73,165,66,133,74,169   :rem 219
5513 DATA 14,133,77,32,197,21    :rem 151
5519 DATA 165,63,133,73,165,64   :rem 214
5525 DATA 133,74,169,36,133,77   :rem 215
5531 DATA 32,197,21,165,69,133   :rem 207
5537 DATA 73,165,70,133,74,169   :rem 217
5543 DATA 58,133,77,32,197,21    :rem 162
5549 DATA 160,4,185,86,22,153    :rem 161
5555 DATA 189,31,185,91,22,153   :rem 213
5561 DATA 211,31,185,96,22,153   :rem 201
5567 DATA 233,31,136,16,235,96   :rem 211
5573 DATA 169,0,133,98,133,99    :rem 171
5579 DATA 133,100,162,15,6,73    :rem 151
5585 DATA 38,74,120,248,165,98   :rem 225
5591 DATA 101,98,133,98,165,99   :rem 227
5597 DATA 101,99,133,99,165,100   :rem 10
5603 DATA 101,100,133,100,216,88  :rem 24
5609 DATA 202,16,227,162,2,181   :rem 197
5615 DATA 98,72,74,74,74,74       :rem 77
5621 DATA 32,2,22,104,41,15       :rem 31
5627 DATA 32,2,22,202,16,237      :rem 92
5633 DATA 96,230,77,164,77,9     :rem 123
```

```
5639 DATA 48,153,180,31,96,25      :rem 165
5645 DATA 15,21,32,19,1,22         :rem 247
5651 DATA 5,4,32,20,8,5            :rem 100
5657 DATA 32,16,18,9,14,3          :rem 211
5663 DATA 5,19,19,16,15,15           :rem 6
5669 DATA 18,32,16,18,9,14          :rem 12
5675 DATA 3,5,19,19,32,2           :rem 160
5681 DATA 12,15,14,4,5,12          :rem 196
5687 DATA 12,16,12,1,25,32         :rem 250
5693 DATA 1,7,1,9,14,63            :rem 109
5699 DATA 14,21,13,2,5,18          :rem 207
5705 DATA 32,15,6,32,2,9           :rem 152
5711 DATA 18,4,19,32,49,45           :rem 6
5717 DATA 57,19,3,15,18,5          :rem 215
5723 DATA 2,15,14,21,19,13         :rem 245
5729 DATA 1,7,9,3,12,12            :rem 103
5735 DATA 4,60,12,189,126,0         :rem 50
5741 DATA 48,48,32,60,48,189       :rem 120
5747 DATA 126,0,0,0,84,170         :rem 250
5753 DATA 0,0,0,0,24,36             :rem 89
5759 DATA 90,60,90,24,60,126       :rem 109
5765 DATA 0,0,195,60,24,36           :rem 1
5771 DATA 0,0,0,0,0,126             :rem 83
5777 DATA 153,36,0,0,0,0           :rem 146
5783 DATA 68,60,94,56,64,0          :rem 19
5789 DATA 0,38,124,60,124,58       :rem 111
5795 DATA 72,0,194,102,252,46      :rem 157
5801 DATA 255,90,44,69,254,254     :rem 214
5807 DATA 254,0,239,239,239,0      :rem 159
```

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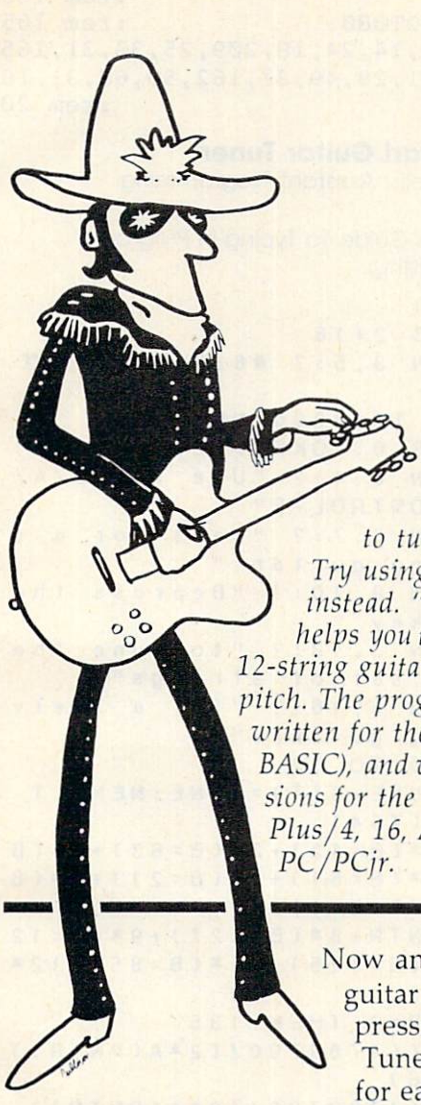
Guitar Tuner

Christopher Visco



Need a pitch pipe to tune your guitar? Try using your computer instead. "Guitar Tuner" helps you tune your 6- or 12-string guitar to perfect concert pitch. The program was originally written for the TI-99/4A (either BASIC), and we've added versions for the Commodore 64, Plus/4, 16, Atari, and IBM PC/PCjr.

Now an accurately tuned guitar is just a few keypresses away. "Guitar Tuner" plays a tone for each string on your 6- or 12-string guitar, freeing your hands to adjust the tuning pegs by ear.

To tune a 6-string guitar, run the program and play the tones by pressing the corresponding letter keys: E for the low (bass) E string; A for the A string; D for the D string; G for the G string; B for the B string; and CTRL-E for the high E string. To tune a 12-string guitar, press the SHIFT (or SHIFT LOCK) key for the second set of strings. This raises the tones by one octave (except for the B and high E strings, which are tuned to the same octave, of course).

If you aren't too familiar with the sound capabilities of your computer, you can learn a lot by studying these simple programs. Notice the DATA numbers at the end of each program; these are the tone values for the sound statements. Some programs convert these numbers with a formula to produce the proper tones. All the tones were verified with a quartz guitar-tuning meter calibrated for standard concert pitch.

A Note About Notes

The accuracy of any note produced by a computer tone generator (or synthesizer) is measured in the number of bits of *frequency resolution.* The more bits, the better. (Don't confuse this with the number of bits handled by the computer's main microprocessor—a 16-bit computer might still have a sound chip with only 8-bit frequency resolution, or vice versa.)

For example, the standard pitch for a middle A note is defined by musicians as 440 hertz (cycles per second). Let's say a certain computer's sound chip is limited to 8-bit frequency resolution. The most accurate A note it could generate might be 437.8 hertz. That's close enough to 440 for some people, but it would sound slightly flat to those with a good sense of pitch.

The TI-99/4A, IBM PC, and PCjr have 12-bit frequency resolution (in fact, the TI and PCjr both use the same Texas Instruments sound chip). Twelve-bit resolution is about the minimum required for people with a good sense of pitch. The Commodore 64 has 16-bit frequency resolution, so it's even more accurate. Commodore's new Plus/4 and 16 have 10-bit resolution, which provides passable results. The VIC-20 has only 8-bit frequency resolution, so Guitar Tuner isn't practical on the VIC. The program is easy to write on the VIC, but the tones are too far out of tune for musicians.

Atari computers also have 8-bit frequency resolution (the slightly flat A note described above is produced by the Atari). However, the Atari version of Guitar Tuner takes advantage of a little-known feature that lets you combine two of the 8-bit tone generators to make one 16-bit generator. This improves the accuracy of an A note from 437.8 to 439.97 hertz—close enough for almost anybody. (For more information on this technique, see "Perfect Pitch," *COMPUTE!'s Second Book of Atari.*)

Program 1: TI Guitar Tuner

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 DIM PITCH(12)
110 FOR T=0 TO 12
120 READ PITCH(T)
130 NEXT T
140 CALL CLEAR
150 CALL SCREEN(15)
160 PRINT TAB(10);"Guitar Tuner":::
    :
170 PRINT "Release the ALPHA-LOCK k
    ey."::
180 PRINT "Use the E/A/D/G/B/CTRL-E
    "::
190 PRINT "keys for a six-string"::
200 PRINT "guitar."::::
210 PRINT "Depress the ALPHA-LOCK k
    ey"::
220 PRINT "to tune the second set o
    f"::
230 PRINT "strings for a twelve-str
    ing"::
240 PRINT "guitar.":::
250 CALL KEY(0,K,S)
260 IF S=0 THEN 250
270 A$=CHR$(K)
280 A=-(A$="e")-2*(A$="a")-3*(A$="d
    ")-4*(A$="g")-5*(A$="b")-6*(A$=
    CHR$(133))-7*(A$="E")-8*(A$="A"
    )-9*(A$="D")-10*(A$="G")-11*(A$
    ="B")
290 CALL SOUND(1500,PITCH(A),2)
300 GOTO 250
310 DATA 40000,165,220,294,392,494,
    659
320 DATA 330,440,588,784,494,659
```

Program 2: Commodore 64 Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
8 DIMHI(12),LO(12),NO$(12)           :rem 115
10 PRINT"{N}{CLR}{13 RIGHT}GUITAR TUNER":
   FOR T= 0 TO 300:NEXT               :rem 55
15 PRINT"{HOME}{4 DOWN}{7 RIGHT}USE THE E
   /A/D/G/B/CTRL-E"                  :rem 140
16 PRINT"{3 DOWN}{5 RIGHT}KEYS FOR A SIX-
   STRING GUITAR."                    :rem 82
17 PRINT"{3 DOWN}{6 RIGHT}DEPRESS THE SHI
   FT LOCK KEY"                      :rem 161
18 PRINT"{3 DOWN}{7 RIGHT}TO TUNE THE SEC
   OND SET OF"                        :rem 53
19 PRINT"{3 DOWN}{2 RIGHT}STRINGS FOR A T
   WELVE-STRING GUITAR."             :rem 207
20 S=54272:FOR T= 0TO23:POKES+T,0:NEXT:PO
   KES+24,12:POKES+5,17:POKES+6,243
                                      :rem 94
70 FOR T=1TO11:READ HI,LO:HI(T)=HI:LO(T)=
   LO:NEXTT                           :rem 32
80 GET A$:IF A$=""THEN 80            :rem 243
90 A=-(A$="E")-2*(A$="A")-3*(A$="D")-4*(A
   $="G")-5*(A$="B")-6*(A$=CHR$(5))
                                     :rem 171
95 A=A-7*(A$="E")-8*(A$="A")          :rem 62
97 A=A-9*(A$="D")-10*(A$="G")-11*(A$="B")
                                      :rem 34
100 POKES,LO(A):POKES+1,HI(A)        :rem 211
150 POKES+4,17:FORI=0TO2000:NEXTI:POKES+4
    ,16                              :rem 183
175 POKE198,0:GOTO80                 :rem 165
200 DATA 10,143,14,24,18,209,25,30,31,165
    ,42,62,21,31,28,49,37,162,50,60,31,16
    5                                 :rem 20
```

Program 3: Atari Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
AG 5 DIM A(14)
HG 10 GRAPHICS 2+16
FG 20 POSITION 3,5:? #6;"gUITaR TU
      nER"
DO 30 FOR T=0 TO 3000:NEXT T
EJ 40 GRAPHICS 0:POKE 752,1
GM 50 POSITION 6,4:? "Use the E/A/
      D/G/B/CONTROL-E"
GH 60 POSITION 6,7:? "keys for a s
      ix-string guitar."
HM 70 POSITION 9,10:? "Depress the
      shift key "
OE 80 POSITION 3,13:? "to tune the
      second set of strings"
CB 90 POSITION 6,16:? "for a twelv
      e-string guitar."
EB 120 FOR T=0 TO 12
FC 130 READ TUNE:A(T)=TUNE:NEXT T
CP 135 B=PEEK(764)
JF 137 PNTR=1*(B=42)+2*(B=63)+3*(B
       =58)+4*(B=61)+5*(B=21)+6*(B
       =170)+7*(B=106)
HO 138 PNTR=PNTR+8*(B=127)+9*(B=12
       2)+10*(B=125)+11*(B=85)+12*
       (B=234)
KF 139 IF PNTR=0 THEN 135
DN 141 P2=INT((1789790/(2*A(PNTR))
       -7)/256)
FE 142 P1=INT(1789790/(2*A(PNTR))-
       7-256*P2+0.5)
AN 143 POKE 53768,80:POKE 53760,P1
       :POKE 53762,P2:POKE 53763,(
       16*10)+10
GC 156 FOR I=1 TO 3000:NEXT I
NI 157 POKE 764,0:SOUND 0,0,0,0:SO
       UND 1,0,0,0
GM 163 GOTO 135
FP 170 DATA 0,165,220,294,392,494,
       659,330,440,588,784,494,659
```

Program 4: PC/PCjr Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
LG 10 CLS:KEY OFF
AB 20 WIDTH 80:DIM PITCH(12):DEF SEG =
      0:POKE 1047,0
JH 30 LOCATE 1,34:PRINT"Guitar Tuner"
EE 40 LOCATE 4,28:PRINT"Use the E/A/D/
      G/B/CTRL-E"
JF 50 LOCATE 7,26:PRINT "keys for a si
      x-string guitar."
```

```
EN 60 LOCATE 10,28:PRINT"Depress the C
      aps Lock key"
GE 70 LOCATE 13,28:PRINT"to tune the s
      econd set of"
BN 80 LOCATE 16,24:PRINT"strings for a
       twelve-string guitar."
GH 90 FOR T= 0 TO 12:READ PITCH:PITCH(
      T)=PITCH:NEXT
PL 100 LOCATE 20,33:IF PEEK(1047) AND
       64 THEN PRINT"CAPS LOCK ON "ELS
       E PRINT"CAPS LOCK OFF"
BF 110 A$= INKEY$:IF A$=""THEN 100
MJ 120 A=-(A$="e")+2*-(A$="a")+3*-(A$=
       "d")+4*-(A$="g")+5*-(A$="b")+6*
       -(A$=CHR$(5))+7*-(A$="E")+8*-(A
       $="A")+9*-(A$="D")+10*-(A$="G")
       +11*-(A$="B")
GI 130 SOUND PITCH(A),20
BP 140 GOTO 110
CG 150 DATA -32767,165,220,294,392,494
       ,659
CI 160 DATA 330,440,588,784,494,659
```

Program 5: Commodore Plus/4 & 16 Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 DIMNO(12)
20 PRINT"{N}{CLR}{13 RIGHT}GUITAR TUNER":
   FOR T= 0 TO 300:NEXT
30 PRINT"{HOME}{4 DOWN}{7 RIGHT}USE THE E
   /A/D/G/B/CTRL-E"
40 PRINT"{3 DOWN}{5 RIGHT}KEYS FOR A SIX-
   STRING GUITAR."
50 PRINT"{3 DOWN}{6 RIGHT}DEPRESS THE SHI
   FT LOCK KEY"
60 PRINT"{3 DOWN}{7 RIGHT}TO TUNE THE SEC
   OND SET OF"
70 PRINT"{3 DOWN}{2 RIGHT}STRINGS FOR A T
   WELVE-STRING GUITAR."
80 FOR T=0TO12:READ NO:NO(T)=NO:NEXTT
90 GET A$:IF A$=""THEN 90
100 A=-(A$="E")+2*-(A$="A")+3*-(A$="D")+4
    *-(A$="G")+5*-(A$="B")+6*-(A$=CHR$(5)
    )
110 A=A+7*-(A$="E")+8*-(A$="A")
120 A=A+9*-(A$="D")+10*-(A$="G")+11*-(A$=
    "B")
130 IF A=0THEN 90
140 VOL 7:SOUND 1,NO(A),180
150 GOTO90
160 DATA 0,345,516,643,739,798,854,685,77
    0,834,881,798,854                    ©
```

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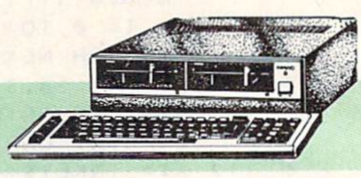

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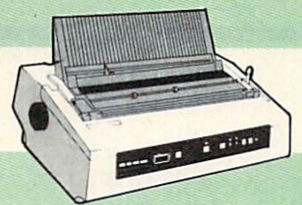

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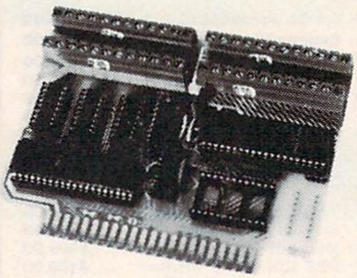

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A synthesizer is something like an electric organ, except it's far more powerful. It's a computer that plays music. Through its keyboard, you can sometimes come amazingly close to the sounds of acoustic instruments. And because you are able to control all the elements of a sound, you can also create instruments that have never been heard before. It's a remarkably fertile environment and musicians are just beginning to tap its potential.

Why Buy An Organ?

Now that quality synthesizers are relatively inexpensive, more and more people are considering them as an alternative to the traditional home organ or piano. After all, why buy an organ when it will always—no matter what button you press—sound like an organ? A synthesizer has all those organ sounds, but also has a harpsichord sound that you cannot distinguish from the real thing, as well as dozens of other sounds which more or less duplicate traditional instruments.

When you've got a whole orchestra at your disposal, one of the first things you want to do is *orchestrate*. That's where a sequencer comes in.

Historically, very few people have had the talent or the luck to be able to experiment with orchestration: combining various instruments into a musically pleasant arrangement. Those days are over. On some synthesizers you can play a viola part, then listen to the viola playing back while you add a violin melody. Next, while listening to the viola and violin, you can lay down a harpsichord and later put in a flute or whatever. Instant chamber ensemble. You've become a one-man band.

There are two ways to layer the different sounds of a synthesizer: with a multitrack tape recorder (expensive), or with a sequencer (now inexpensive). A sequencer is like a digital tape recorder, except you've got more control than is possible with a tape recorder.

Laying Down Tracks

Here's how it works:

1. You tell the sequencer that you're about to lay down track 1.
2. You play the synthesizer keyboard, perhaps a bass guitar sound.
3. As you're playing, the sequencer is memorizing the volume, the voice, the speed, the rhythm, the individual notes, and even expression (how hard you pressed the keys, assuming your synthesizer has a velocity-sensitive keyboard).
4. You then instruct the sequencer to start playing track 1 while simultaneously recording track 2.
5. While listening to the bass line on track 1, you come in hard with a lead guitar.
6. Repeating this process, you can add up to six tracks with the Sequential Circuits Sequencer.

"The machine works in a trouble-free manner, and is really a pleasure to use."
Robert J. Burdett—Oak Park, Illinois

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Michael DiJulio—Chicago, Illinois

"You have an excellent machine for the home user. Smart LOGO and Smart Filer are excellent…Smart Keys make it very easy to use the software, even before you read the instructions completely."
Wayne Motel—Dyer, Indiana

"Your keyboard is better than the Apple.*" Donald Prohaska—San Diego, California

"I find the word processor and the basic programming language to be very user friendly."
Gordon R. Franke—Kirksville, Missouri

"I am more than pleased with the operation of the machine, and not having any experience with computers, I am happy that finally someone has produced a machine not only at a reasonable cost, but one that you can nearly sit down and start using without any training period."
Frederick A. Tripodi—New York, New York

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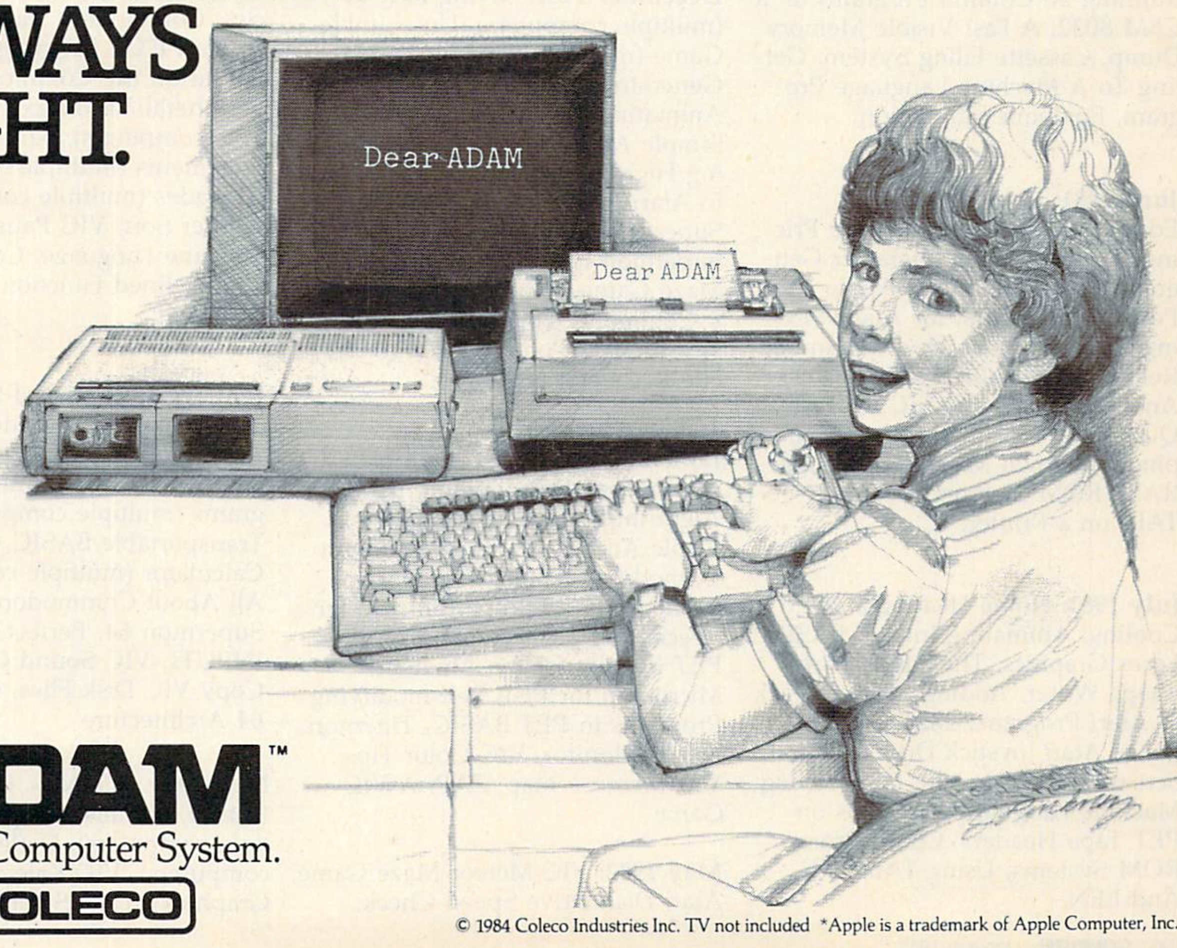

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COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of COMPUTE!. Each issue contains much, much more than there's space here to list, but here are some highlights:

Home and Educational COMPUTING! (Summer 1981 and Fall 1981—count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters On The VIC, Alternative Screens, Automatic VIC Line Numbers, Using The Joystick (Spacewar Game), Fast VIC Tape Locater, Window, VIC Memory Map.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032, A Fast Visible Memory Dump, Cassette Filing System, Getting To A Machine Language Program, Epidemic Simulation.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever Expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, Quadra PET: Multitasking?, Mapping Unknown Machine Language, RAM/ROM Memory, Keeping TABs on a Printer.

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, Using TAB, SPC, And LEN.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying, Adding A Programmable Sound Generator, Converting PET BASIC Programs To ASCII Files.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, and VIC; Budgeting on the Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train Your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (multiple computers), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Atari Word Processor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game, Replacing The INPUT # Command, Foreign Language Text on The Commodore Printer, File Recovery.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: A VIC Monitor, VIC Color Tips, VIC Memory Map, ZAP: A VIC Game.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, A VIC Light Pen For Under $10, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of TRON, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Commodore Disk Fixes, The Apple PILOT Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Commodore User-defined Functions Defined, A VIC Bug.

January 1983: Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon 64, Perfect Commodore INPUTs, VIC Sound Generator, Copy VIC Disk Files, Commodore 64 Architecture.

May 1983: The New Low-Cost Printer/Plotters, Jumping Jack (multiple computers), Deflector (multiple computers), VIC Kaleidoscope, Graphics on the Sinclair/Timex,

COMPUTE! Back Issues

Bootmaker For VIC, PET and 64, VICSTATION: A "Paperless Office," The Atari Musician, Puzzle Generator (multiple computers), Instant 64 Art, 64 Odds And Ends, Versatile VIC Data Acquisition, POP For Commodore.

June 1983: How To Buy The Right Printer, The New, Low-Cost Printers, Astrostorm (multiple computers), The Hawkmen Of Dindrin (multiple computers), MusicMaster For The Commodore 64, Commodore Data Searcher, Atari Player/Missile Graphics Simplified, VIC Power Spirals, UnNEW For The VIC and 64, Atari Fast Shuffle, VIC Contractor, Commodore Supermon Q & A.

July 1983: Constructing The Ideal Computer Game, Techniques For Writing Your Own Adventure Game, SpeedSki And Time Bomb (VIC), Castle Quest And Roadblock (Atari), RATS! And Goblin (64), How To Create A Data Filing System (multiple computers), How To Back Up Disks For VIC And 64, Atari Artifacting, All About The Commodore USR Command, TI Mailing List.

August 1983: Weather Forecaster (multiple computers), First Math And Clues (multiple computers), Converting VIC And 64 Programs To PET, Atari Verify, Apple Bytechanger, VIC And 64 Escape Key, Banish Atari INPUT Statements, Mixing Graphics Modes On The 64, VICplot, VIC/64 Translations: Reading The Keyboard, Musical Atari Keyboard, VIC Display Messages.

September 1983: Games That Teach, Caves Of Ice, Diamond Drop, Mystery Spell, and Dots (multiple computers), VIC Pilot, Ultrasort (VIC, 64, PET), Easy Atari Page Flipping, Computer Aided Design On The TI, Relative Files On the VIC/64, Atari Fontbyter, TI Sprite Editor, All About Interrupts (multiple computers), Cracking The 64 Kernal, Making Change On The Timex/Sinclair, Build Your Own Random File Manager (multiple computers).

October 1983: Computer Games By Phone, Coupon File (multiple computers), Dragon Master And Moving Maze (multiple computers), Merging Programs From Commodore Disks, Atari Master Disk Directory, Sprites In TI Extended BASIC, Commodore EXEC, Multicolor Atari Character Editor, High Speed Commodore Mazer, Apple Sounds, Extra Instructions (multiple computers), Commodore DOS Wedges, Invisible Disk Directory For VIC And 64.

February 1984: What Makes A Good Game, Circus (multiple computers), Quatrainment (multiple computers), Commodore 3-D Drawing Master (Apple version also included), Speedy BASIC For VIC And 64, Dr. Video 64.

March 1984: All About Adding Peripherals, Modern Memory: The Future Of Storage Devices, Roader (multiple computers), Barrier Battle (multiple computers), Programming The TI: File Processing, Sound Shaper (multiple computers), Commodore Floating Subroutines, Big Buffer For Atari.

April 1984: Apple's Macintosh Unveiled, Securities Analysis (multiple computers), Worm Of Bemer (multiple computers), Programming The TI: File Processing, Part 2, 1540/1541 Disk Housekeeping, Hidden Atari DOS Commands, Function Keys For The Apple, TI Tricks And Tips, Super Directory (multiple computers).

May 1984: The Digital Palette: Fundamentals Of Computer Graphics, The Inside Story: How Graphics Tablets And Light Pens Work, Picture Perfect For Atari And Commodore 64, 64 Hi-Res Graphics Editor, Snertle (multiple computers), Pentominos: A Puzzle-Solving Program (multiple computers), A BASIC Cross-Reference (PET, 64).

June 1984: Choosing The Right Printer: The Easy Way To Hard Copy, Pests (multiple computers), Olympiad (multiple computers), Programming The TI: TI Graphics, MacroDOS For Atari, Part 1, Apple Variable Save, Programming 64 Sound, Part 1, Apple Input And Menu Screens.

July 1984: Evolutionary To The Core: The Apple IIc Heads For Home, The ABC's Of Data Bases, Statistics For Nonstatisticians (multiple computers), Bunny Hop (multiple computers), Blueberries (multiple computers), Atari Artist, Applesoft Lister, Program Conversion With Sinclair BASIC And TI BASIC, Commodore 64 ROM Generations.

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To make things even easier, the music industry has accomplished something that has thus far eluded the computer industry: a standardized interface. Called MIDI, it allows you to connect most synthesizers to each other, and allows them to communicate a great variety of musical information. It is through this interface that the sequencer controls one or more synthesizers.

If you use two synthesizers, you can record two voices simultaneously. Also, Sequential Circuits makes a synthesizer called the Six-Trak which can play different voices simultaneously when you add its *Sequencer Expansion Software* package.

Even by itself, the unexpanded sequencer has many attractive features. You can record and play back a musical line on one of the six tracks in the digital recorder. If your synthesizer is polyphonic (can play more than one note at a time), the sequencer will memorize as many notes as you play. Many synthesizers, however, do limit you to playing a single voice, such as a trumpet, at one time.

The six layered tracks, memorized by the sequencer, can be individually edited. Tracks can be looped, erased, copied, or transposed to a new key. You can also change the tempo of your piece after it's recorded—without affecting the pitch.

The combined sound of all six tracks is called a *sequence*. Up to eight different sequences can be chained together to form a complete song, and sequences or songs can be saved on tape or disk.

A Special Autocorrection Feature

One of the most extraordinary features of this powerful music software is called Autocorrection. Any track or song can be automatically brought to greater rhythmic accuracy. In practice, this means that if you're not always quite on the beat, you can have the computer adjust the rhythm to suit your tastes. What's more, you define the degree of accuracy: anything from a quarter note to a thirty-second triplet degree of resolution. That way you can decide how much correction to apply. If things are too perfectly timed, the music can begin to sound mechanical and cold. If they're too loose, it sounds amateurish, untalented.

If you've ever wanted to try composing music, conducting an orchestra, or running a recording studio, the Sequential Circuits Sequencer, a synthesizer, and your Commodore 64 will now give you the essential tools. You'll probably be surprised at the quality of the music you can invent with a little help from these friends.

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Sunburst Educational Software

Glenn M. Kleiman and Susan Keyes

Requirements: Atari, Apple II series, Commodore 64, IBM PC/PCjr, TRS-80 Color Computer, or TRS-80 Models I/III/4. Not all the programs reviewed are available for all computers; see notes at end of review for specific system requirements. The versions reviewed here were for the Atari, but all versions are similar.

Educators are finding the search for classroom software to be time-consuming, difficult, and frustrating. There are hundreds of packages available, and publishers are expending a great deal of effort marketing them to schools. Yet teachers tell us that most of the software they see does not meet their needs.

Teachers are looking for high-quality software—software that is easy to use, holds students' interest, and helps students learn. They need software that fits into the curriculum and also expands upon what can be done with books, slides, and films. They want programs that make good use of the flexibility and interactiveness of computers.

Most schools have a very limited number of computers. Teachers therefore need programs that each child can use for a short time, or that groups of children can use together.

Since each classroom contains children with a variety of interests and abilities, teachers also need programs with several levels so students do not become frustrated with tasks that are too difficult, or bored with tasks that are too easy.

Teachers want supporting print materials that provide students with the background information necessary to make good use of their time on the computer. They also want materials that help them relate the computer program to other lessons and activities. In addition, they need reasonably priced software packages that contain a backup copy of the disk.

When we ask teachers where they find software that meets these requirements, one company, Sunburst Communications, is mentioned more than any other. Sunburst's software packages contain well-designed programs that address curriculum objectives and provide enjoyable, worthwhile activities for students. They also contain supporting print materials for both teachers and students.

Here we'll review four products that are good examples of the quality and diversity of Sunburst products. *SemCalc* is a math program, *M-ss-ng L-nks* is a language arts program, and *The Factory* and *The Incredible Laboratory* are logic/problem-solving programs.

Sunburst software is available in both classroom and home versions. Aside from packaging, the only differences are that classroom versions cost more ($55 to $95) and include a thorough teacher's guide, a backup disk, and a lifetime warranty. Home versions come with a smaller parent's guide and a 90-day warranty and retail for $39.95. However, *SemCalc* is not available in a home version, and the only edition of *M-ss-ing L-nks* for home use is "Young People's Literature."

SemCalc

SemCalc, which is short for Semantic Calculator, was developed by Judah Schwartz. This program helps students analyze arithmetic story problems into their critical components. The program provides the student with an onscreen "pad" to record the elements of a problem, line by line, in terms of quantity ("How many?") and kind ("Of what?"). When the student tries to add different kinds of things (for example, apples and oranges), the program responds: "Can apples be converted to oranges—or can oranges be converted to apples?" When, as in this case, the answer is no, the program asks: "Apples and oranges are both what?" The student then supplies an appropriate category. In cases where one term can be converted into the other, as with hours and minutes, the student supplies the appropriate formula for making the conversion. Similar prompts and aids are provided for multiplication and division problems.

SemCalc was designed to help students determine solutions, not simply to provide correct answers. For example, if the student enters "pollywogs" as the common category for apples and oranges, the program will indicate that 7 apples plus 8 oranges equals 15 pollywogs. If the student indicates that there are 60 hours in a minute, the program will multiply the number of minutes by 60, add this quantity to the hours, and indicate the sum as the correct answer in hours. Thus it is up to the student to specify, and therefore understand, the correct relationships among the elements of a problem.

SemCalc comes with a tutorial on disk that, though somewhat repetitive, clearly describes how to use the program, and guides the student through some sample problems. The tutorial also illustrates that the program itself cannot "think," but merely responds faithfully to student input regardless of its factual accuracy. It is a valuable reminder for adults as well as children that the quality of the output is dependent on the quality of the input.

SemCalc is an interesting, useful, and unusual product. Given the difficulty many children have in extracting and organizing relevant data from story problems, it can serve as a useful tool in a variety of classroom applications.

M-ss-ng L-nks

M-ss-ng L-nks is a language arts program designed by Carol Chomsky and Judah Schwartz. It provides a series of puzzles in which the student fills in blanks to complete words in a passage. By solving these puzzles, the student develops reading and vocabulary skills while discovering patterns in the structure of language. This program is modeled on the "cloze procedure" used by many reading teachers and some standardized reading tests.

M-ss-ng L-nks is based on excerpts from written materials and comes in several editions: "Young People's Literature," "Classics, Old and New," and "MicroEncyclopedia." We reviewed the "Young People's Literature" program, which provides a selection of nine passages from each of nine books. Included are such favorites as *The Wind in the Willows, Charlie and the Chocolate Factory*, and *The Lion, the Witch, and the Wardrobe*. A separate editor program is available for teachers, parents, or children who want to create their own texts and puzzles.

When using *M-ss-ng L-nks,* students first select a passage. Then they select one of the nine available puzzle formats. These range from a format with all the vowels deleted to a format with no clues at all. The options are displayed in a cleverly designed menu, in which the first five choices are shown as:

A. Wh-ch f-rm-t d- y-- w-nt?
B. W-i-h -o-m-t -o -o- w-n-?
C. W---- f----- d- y-- w---?
D. Which ------ do --- want?
E. --i-- -o--a- -o -ou -a--?

M-ss-ng L-nks can be used by one or two children. The players can set limits on the number of guesses allowed for each letter (from 1 to 5) and, for the two-player mode, the number of guesses per turn (from 3 to 15).

We played *M-ss-ng L-nks* with several different passages and a variety of formats. We were pleased to discover how engaging the activity is and how much knowledge about the structure of the English language and spelling is brought to bear while completing the passages. *M-ss-ng L-nks* can provide many hours of enjoyable, worthwhile activity.

The Factory

The Factory, designed by Marge Kosel and Mike Fish, is one of Sunburst's most popular problem-solving programs. Within this program, factories can be created, using machines that perform three types of operations upon a square object: Punch, Rotate, and Stripe. Punch machines can be set to make one, two, or three round or square punches. Rotate machines can turn the object 45, 90, 135, or 180 degrees. Stripe machines can draw thin, medium, or thick lines. Each machine is represented by a well-designed computer illustration.

A factory can have up to eight machines in any sequence. When a factory makes an object, the computer shows a square moving through each machine in turn, as if it were on an invisible conveyor belt. Clever animation shows each machine operating on the square, thereby providing a clear picture of what is happening during each step of the process.

For example, a factory could consist of a Stripe machine, a Rotate machine set for 90 degrees, and a second Stripe machine. When this factory makes an object, first it draws a stripe, then rotates the object 90 degrees, and then draws a second stripe. When the process is completed, the finished object is displayed. The object produced by this example factory would have two stripes drawn at right angles to each other.

During the first segment of the program, " Test A Machine," students select machines one by one to see what effect each produces using each of the available options. In the second section, "Build A Factory," students make their own factories to create novel products.

In the third section, "Make A Product," students are assigned target products and asked to reproduce them by assembling appropriate sets of machines. The need to understand the effects of rotations—both the correct angle of rotation and the correct timing of a rotation—can make for very challenging problems. In fact, this aspect of the program makes *The Factory* one of the best exercises in spatial reasoning that we have seen.

The Factory is well designed and very easy to use. It provides good problem-solving practice for students working individually or in small groups, and it can be used within the time limits of typical classroom situations. However, if students have time to really explore the program, they are likely to want machines that can do more things, such as a Punch machine that lets them position the hole or a Stripe machine that lets them select the color of each stripe. The addition of such options would create more diversity and add greater depth to the program.

The Factory provides a rich set of problem-solving activities. Students gain experience making deductions, sequencing operations, and discovering multiple solutions to a common goal. More than that, the program is fun. It will make a welcome addition to any school software library.

The Incredible Laboratory

The Incredible Laboratory, designed by Marge Kosel and Jay Carlson, is a problem-solving program in much the same spirit as *The Factory.* This program contains three levels: Novice, Apprentice, and Scientist. All levels include both a Play and a Challenge mode.

The Novice level illustrates the basic play activity. It presents a list of six chemicals. The student's task is to determine which chemical controls each of the six components of a monster: head, eyes, body, arms, legs, and feet. Students select chemicals to form a Monster, and then watch as the creature is slowly distilled from a large beaker. The resulting monsters have wonderfully funny and horrible features. Students repeatedly create monsters, systematically varying the chemical combinations until they determine the effect of each chemical.

At the Apprentice and Scientist levels, more chemicals are available, and students can explore how various combinations of chemicals interact.

When the chemicals and their effects are understood, the student can select the Challenge mode and, along with another player, create a chemical brew. The two players must then try to recognize the monster they have jointly created from three potential Monster candidates.

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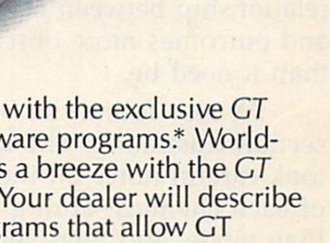

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After the players place their votes, the real Monster is identified as the imposters melt away.

In both the Novice and Apprentice levels, chemicals always produce the same results. At the Scientist level, however, chemicals produce different effects each time that level is selected. The chemical that once produced a Frankenstein-like head may now yield furry legs, or arms with claws, or evil eyes.

The Incredible Laboratory offers delightful graphic effects with a captivating set of problem-solving tasks. However, several aspects of the program can be confusing. For example, when a chemical is left out of the Monster mix, the body part it controls is randomly supplied by the program. The program may randomly substitute the exact body part that the missing chemical would have supplied. This makes the relationship between chemicals and outcomes more obscure than it need be.

We also found the Scientist section frustrating. Though we took careful notes on the effects of each chemical during the Play mode, and then verified our observations before choosing the Challenge mode, we could never accurately predict the results of our challenge monsters. With no way to return to the Play mode, we could never refine our hypotheses or verify where the error lay—in our powers of observation or in the program. While there are several improvements we would like to see, *The Incredible Laboratory* does provide exercises that stretch the mind and results that delight the eye.

Our overall reaction to the Sunburst software we reviewed is very positive. The software packages are well-suited to classroom use and meet the criteria teachers have given for good classroom software. The programs are attractive and the activities they present are worthwhile and enjoyable.

SemCalc
Available for Apple II series, Atari, and TRS-80 Models I/III/4; all versions require at least 48K RAM and a disk drive. Produced in classroom versions only for $95.

M-ss-ng L-nks
Available for Apple II series, Atari, Commodore 64, IBM PC/PCjr, and TRS-80 Models I/III/4; all versions require at least 48K RAM and a disk drive except for the IBM version, which requires 64K RAM and a disk drive. Classroom versions of all editions reviewed cost $55 each.

The Factory
Available for Apple II series, Atari, Commodore 64, IBM PC/PCjr, and TRS-80 Color Computer; all versions require at least 48K RAM and a disk drive except for the Atari version (16K RAM and disk), the IBM version (64K and disk), and the Color Computer version (32K RAM and disk). Classroom versions cost $55.

The Incredible Laboratory
Available for Apple II series, Atari, and Commodore 64; all versions require at least 48K RAM and a disk drive. Classroom versions cost $55.

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CAPUTE!

Modifications Or Corrections To Previous Articles

TI Disassembler

This machine language deciphering aid from the October 1984 issue (p. 159) has a number of shortcomings. First, the article incorrectly stated that the program could easily be translated to standard BASIC. Unfortunately, TI's built-in BASIC lacks the AND operator used throughout the program. The program also fails to properly decode backward jumps and some Format III opcodes, and has several other minor bugs. To correct these problems, the following lines need to be changed as indicated:

```
440 N=(H AND 11)*256 :: J=1792 :: C
    O=(L AND 240)/16 :: WR=(L AND 1
    5):: RESTORE 1040 :: Z=4 :: K=2
    56 :: GOSUB 900
485 IF L>127 THEN L=L-256
680 GOTO 630
700 RESTORE 1080 :: J=12288 :: N=(H
     AND 240)*256 :: Z=12 :: K=4096
     :: GOSUB 900
740 IF TD=12 THEN C$=",*R"&STR$(D)&
    "+" :: GOTO 770
750 IF (TD=8)AND(D=0)THEN C$=","&"@
    "&STR$(O1*256+O2):: A=A+2 :: IF
     TS=32 THEN C$=","&"@"&STR$(O3*
    256+O4)
```

Thanks to Glenn Davis, Henry Satinskas, and others who ferreted out these errors.

Spiders For IBM PC And PCjr

Some punctuation characters were garbled in printing the listing for Program 7 (p. 98) of this game from the November 1984 issue. In line 170, there should be a colon—not a period—between LOCATE 25,1 and PRINT. In line 330, the character between AX$(Y) and CHR$(BX) should be a comma.

TI Reflection

Line 1600 in Program 5 (p. 76) of this game from the November issue is too long to be entered in standard TI BASIC, although it can be entered if you're using Extended BASIC. To use the program with the built-in BASIC, split the line into two parts, as shown below (be sure to include the semicolon at the end of line 1600):

```
1600 PRINT A$,B$,B$,A$&"   'S",B$,B$
     &" UP",A$,B$,B$,A$,B$,B$,A$&"
     SUM",B$,B$&" x:",A$,B$,B$,A$,B
     $&" "&CHR$(128);
1605 PRINT ":",B$,A$,B$,C$;
```

64 Horse Racing

The correction listed in last month's CAPUTE! for the VIC version of "Horse Racing" actually applies to the Commodore 64 version. There are no corrections for the VIC version. ©

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THE BEGINNER'S PAGE

Tom R. Halfhill, Editor

Which Computer Language Is Best?

Most of us have heard the Biblical story about the Tower of Babel—how God made mankind speak in hundreds of different languages for daring to build a tower to heaven.

In the computer age we seem to suffer from a similar problem. We're burdened with scores of different computer programming languages. And like human languages, they're all largely incompatible with each other.

There are, however, definite reasons why we have so many human languages and computer languages. Both were invented because of the need to communicate ideas. The first language for a modern electronic computer was invented in the 1950s for a specific purpose—to make it easier for people to program computers. Today there are scores of different languages and dialects within languages.

Why, then, if computer languages are conscious inventions all conceived for the same reason, do we have so many of them? Why does one language use the word PRINT to put messages on the screen while another uses TYPE? Why weren't words and definitions standardized from the very beginning to eliminate confusion?

A Language For Every Purpose

One answer is that it's no more realistic to expect a single programming language to be suitable for all possible tasks than it is to expect one type of computer to be ideal for every possible application. Another answer is that those who write languages all have their own ideas about how computers should be programmed (or, depending on your point of view, how humans should be programmed to work with computers). In addition, some languages are hard to implement on certain types of computers, especially home computers with relatively small amounts of memory.

That leaves it up to us to sort out the confusion and decide which language to use to get the job done. Generally there are three things to consider: the suitability of the language to the task; the ease of learning and using the language; and the availability of the language on the computer we want to use.

Here's a summary of the most popular languages available today for home and personal computers:

• *BASIC (Beginner's All-purpose Symbolic Instruction Code).* Invented in the early 1960s at Dartmouth College, BASIC was originally designed as a very simple language that beginners could pick up and use with only a few hours of study. Since then, there have been so many extensions and spin-off dialects that BASIC is used to program everything from videogames to powerful business applications. As a result, some people criticize BASIC as a messy, unstructured hodgepodge of commands. Others find it simple, effective, and versatile. Because BASIC has been built into nearly all microcomputers for years, it's by far the dominant language in personal computing. That doesn't seem likely to change in the near future.

• *Logo.* Designed in the 1970s especially for children, Logo is found primarily on home computers and includes *turtle graphics,* a simplified system for drawing pictures on a video screen. You control a small cursor, the turtle, which can be rotated and moved in different directions while leaving behind a colored trail. Series of commands can be grouped into procedures and executed repeatedly to create geometric patterns. Logo also helps teach logical thinking and organization.

• *PILOT (Programmed Instruction, Learning, Or Teaching).* This language resembles Logo and usually includes turtle graphics. It also has flexible word-matching commands that make it easier to write educational programs which ask questions and evaluate answers.

• *Pascal (named after Blaise Pascal, the seventeenth-century French mathematician).* Invented in the 1970s partly as a reaction to the perceived weaknesses of BASIC, Pascal is known as a *structured* language and is widely used to teach programming at the college level. Programs written in Pascal usually have a modular, organized construction. Although Pascal doesn't

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necessarily force this structure on the programmer, it strongly encourages it.

• *Forth (so-named because it was conceived as a "fourth-generation" language).* Forth is an unusual language, known for its speed of execution, flexibility, and reverse Polish notation arithmetic. It's used for many scientific applications, especially in astronomy, and has a vocal following among microcomputer hobbyists. Forth is one of the few languages that can be readily extended by the programmer. It lets you define your own commands by linking together a series of simpler commands. This new command, in turn, can be used to build commands which are even more powerful.

BASIC: Bread And Butter

For most personal computer programming, BASIC is the first choice. Not necessarily because it's the best language—BASIC certainly has its share of shortcomings. However, it does satisfy the three considerations mentioned above: It's a true general-purpose language which can do a lot of things adequately; it's fairly easy to learn and use; and, perhaps most important, it's widely available. Chances are BASIC is built right into your computer as a standard feature. If not, it's available separately at minimum cost.

BASIC runs on practically every computer because it doesn't require lots of memory. That's partly why it was the first language of its type adapted to microcomputers, back in the days when 4K of RAM was considered luxurious. Even the old Sinclair ZX-81, which came with only 1K of RAM, had a fairly powerful built-in BASIC. What's more, BASIC usually doesn't require you to buy a disk drive or other expensive peripherals. Nearly all BASICs can work with tape storage.

BASIC has other things going for it, too. The vast majority of program listings published in computer magazines and books are in BASIC. It's not that authors don't submit programs written in other languages. It's just that BASIC is the only language which editors can be sure their readers own. Publishing a program in a language like Pascal or Forth renders it useless to 90 percent of the readership. Unavoidably, of course, this policy solidifies BASIC's position and perpetuates its dominance.

BASIC also comes in many flavors. If the BASIC that came with your computer isn't powerful or flexible enough for your purposes, you can probably buy an *extended* or *enhanced* BASIC. For instance, the BASIC built into the Commodore 64 lacks commands to take advantage of the computer's excellent sound and graphics capabilities. If you want to easily write a program using sound and graphics, you can plug in a *Simons' BASIC* cartridge and gain 114 more commands. Similarly, trade-offs made by the designers of Atari BASIC omitted certain features (such as string arrays) which are considered standard in the more common Microsoft BASICs. If this matters, you can buy an extended Microsoft BASIC on cartridge or disk.

Despite all the criticisms leveled at BASIC, for the foreseeable future it's here to stay.

When To Switch

All these reasons don't mean you're pinned down to BASIC by any means. Here are some situations when you might want to make your computer bilingual:

—You're writing a program that simply demands more power, speed, or flexibility than BASIC can deliver.

—You're writing programs only for yourself that won't be shared with other people or submitted to general-interest publications.

—You've run across a program so useful that it's worth your while to buy the language you need to run it.

—You'd like to introduce youngsters to computer programming without bogging them down in the picky details of BASIC.

—You're learning another language at school or work and want to practice writing programs at home with your own computer.

—You want to explore alternatives to BASIC just out of curiosity.

Second languages are available for most computers on cassettes, disks, and cartridges. Cartridges are handiest because you don't have to wait around for a long program (the language) to load—you just plug it in and switch on the computer. Cartridges are also sturdy and generally don't require a disk drive. But because the memory capacity of a cartridge is severely limited (usually no more than 16K), many languages won't fit in a cartridge and are available only on disk.

If you already know one computer language, such as BASIC, you'll find that it's easier to learn a second language—certainly much easier than learning to speak and read a second human language. Human languages have vocabularies of tens of thousands of words, and the rules of syntax are often vague and conflicting. But most computer languages have a total vocabulary of only 50 to 100 words, and the rules for using them are carefully defined. The computer even tells you when you make a mistake. Plus, the fundamental knowledge you gain by learning your first language lets you adjust fairly quickly to the rules of the new language.

The Computer's Native Tongue

You may have noticed one popular computer language missing from the list above: *assembly language* or *machine language* (for now we'll use both terms synonymously).

We deliberately omitted machine language because it isn't quite a language in the same sense as BASIC, Logo, or Pascal. True, machine language is a method of encoding your ideas so that the computer can understand and act on them. In that sense it *is* a language. But with machine language, you're dealing with the computer on a much more intimate level. You're speaking in its native tongue.

The fact is, languages such as BASIC—known as *high-level languages*—were invented for people, not for computers. They were designed for convenience, so people wouldn't have to program computers in machine language. Why? Because machine language programming can be more exacting. Sometimes it takes a dozen or more commands in machine language to do something as simple as display a message on the screen. You might accomplish the same thing in a high-level language with a single command such as PRINT.

But it's important to realize that the computer doesn't understand BASIC or any other high-level language any more than it knows English. A high-level language is really a sophisticated program which itself is written in machine language. When you use a command such as PRINT, the BASIC language translates the command into the proper sequence of machine language commands. In this form, the computer can carry them out.

Despite the extra steps required when programming directly in machine language, it's still very popular. That's because the translation process required by a high-level language takes time, and some programs demand all the speed and power that the computer can deliver. A program written in machine language bypasses this translation step and runs much faster. Sometimes it's the only way to get the job done. However, as technology advances and computers get faster and faster, it's likely that fewer programs will be written directly in machine language.

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Questions Beginners Ask

Q **I've seen specifications for computers that talk about graphics modes with 320 × 200 pixels, 640 × 200 pixels, etc. But what's a pixel?**

A *Pixels* (an abbreviation for *picture elements*) are the tiny dots on the screen that make up the image. If you look very closely at your computer monitor you can see the dots, although they may be too blurred to see clearly on an ordinary color TV.

All video images are composed of pixels, including regular broadcast video pictures. However, there's no standard size for pixels. They can be large or small. Size is important because the smaller the pixel, the more will fit on the screen, and therefore the more detailed the image will be.

For example, a graphics mode of 320 × 200 pixels means the computer can display 320 pixels horizontally and 200 pixels vertically. That's a total of 64,000 pixels. If the computer has a 640 × 200 graphics mode, it can display 128,000 pixels. With twice as many screen dots to work with, the picture can be twice as detailed. In video terms, the more pixels, the greater the *resolution.*

It might seem that creating superdetailed computer images would be as easy as displaying more pixels. But there are several technical obstacles to overcome.

To begin with, the information which defines how each pixel will appear on the screen must be stored in the computer's memory. The computer must know where each pixel will be placed and what color it will be. The more pixels and colors you want to display, the more memory you need. For example, the IBM PCjr has a graphics mode of 640 × 200 pixels with four colors (SCREEN 6 in Cartridge BASIC). It requires 32K of RAM just to store all this information. A 640 × 200 mode with eight colors would require 64K, and a 640 × 200 mode with 16 colors would eat up 128K.

A related problem is computer speed. The more memory it takes to define how the screen will look, the more time it takes the computer to access that memory. An extremely high-resolution screen could bog down the computer so much that it would run programs noticeably slower. (In fact, to reduce this problem, many computers have separate microprocessors just to control the screen display.)

Finally, there's a limit to how sharply a TV set can resolve a pixel. Computers can be designed to work with special monitors (such as the Apple Macintosh), but home computers must be compatible with ordinary TV sets to reach the mass market. ©

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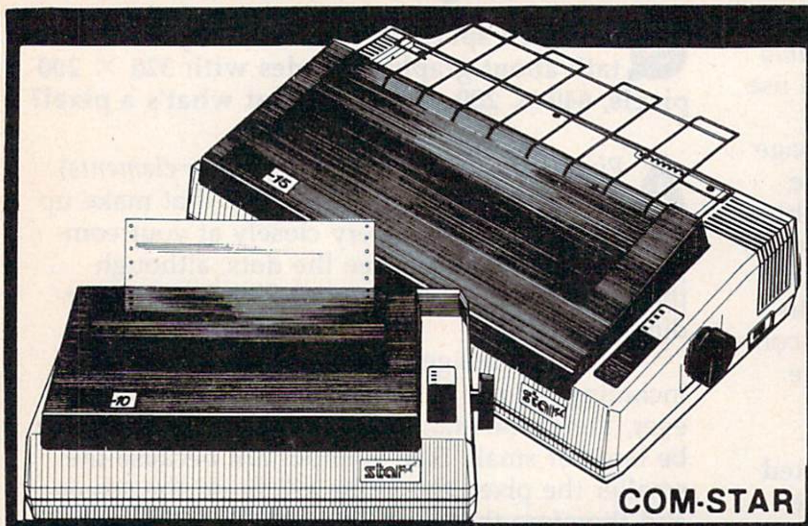

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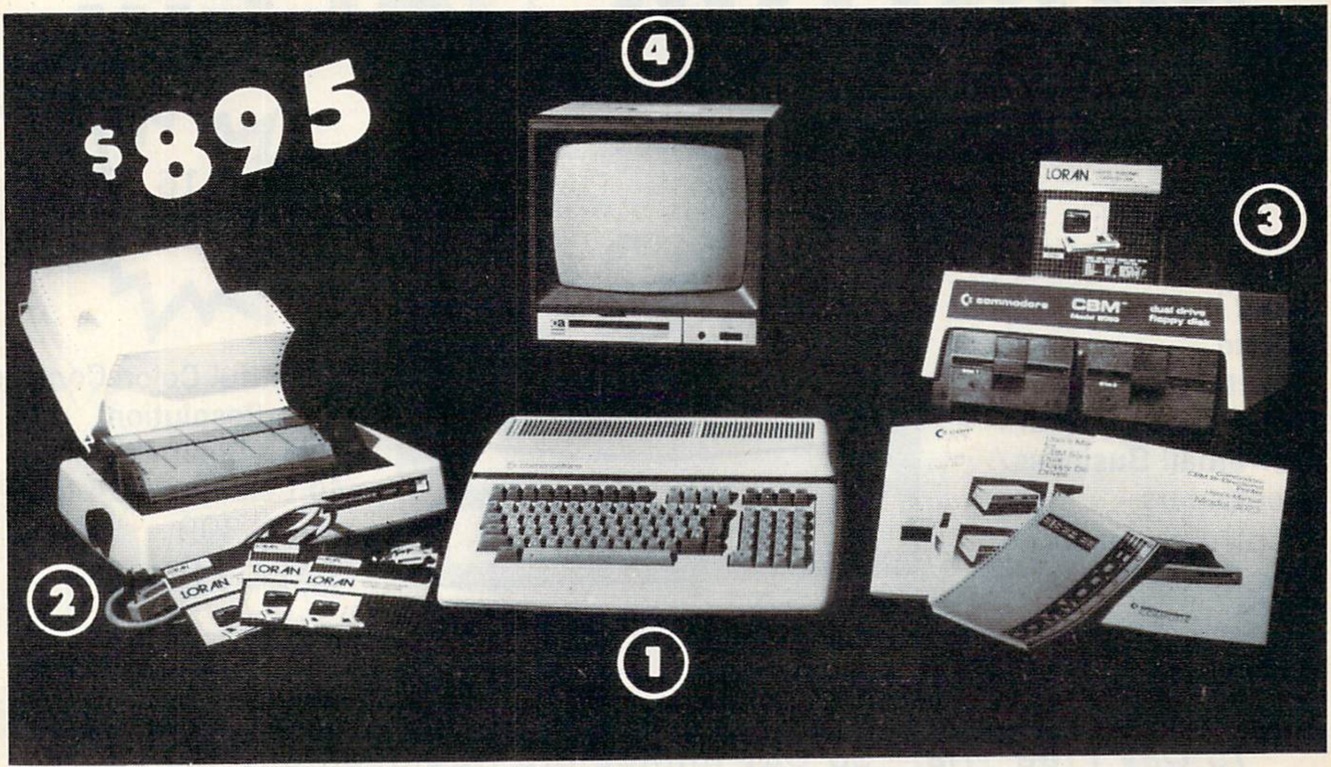

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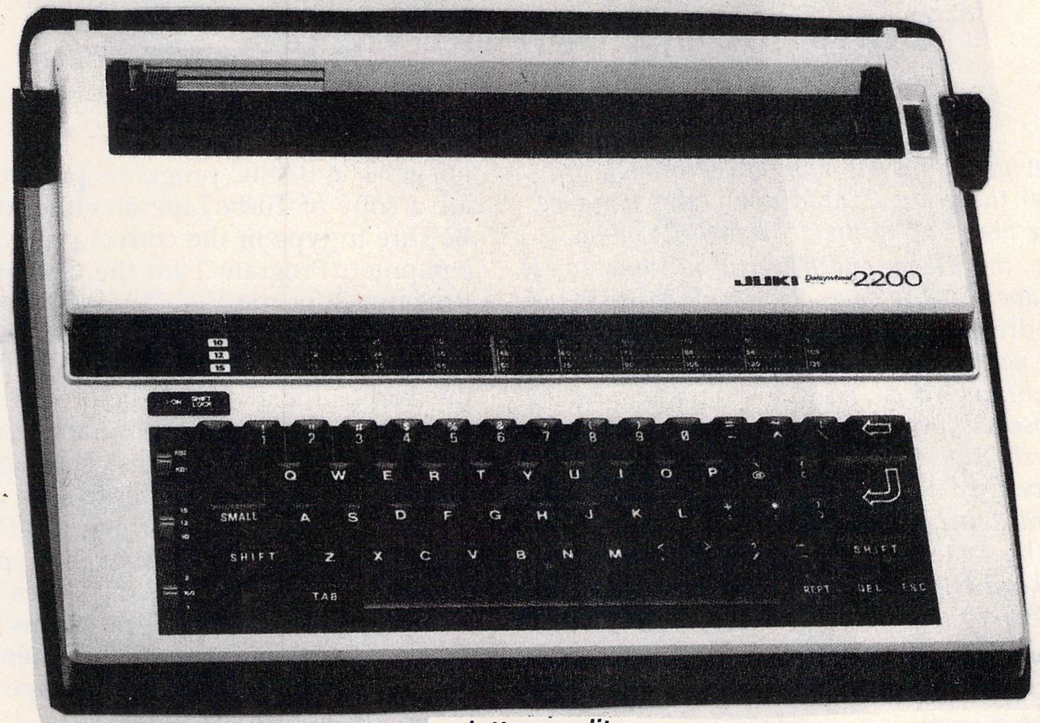

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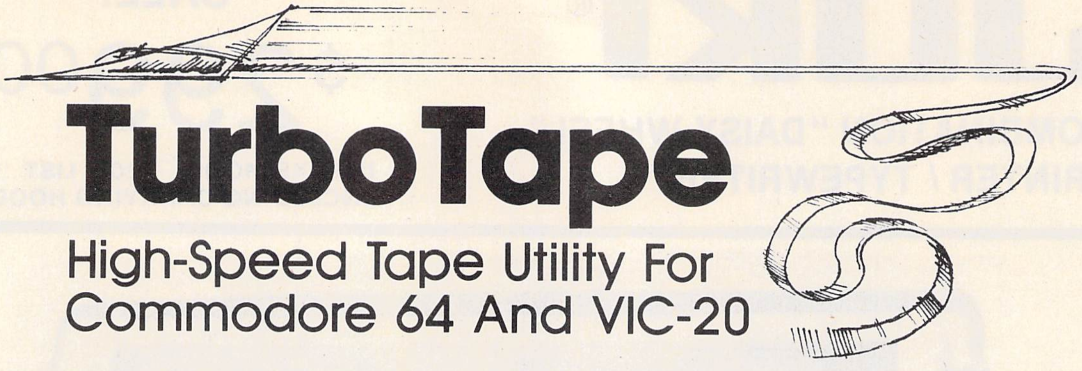

TurboTape

High-Speed Tape Utility For Commodore 64 And VIC-20

Harrie De Ceukelaire

COMPUTE! *has published many breakthrough programs over the years. "TurboTape" takes its place among the very best of them. Though it sounds impossible, this clever and powerful utility actually allows a tape drive to save, load, and verify* as fast as a disk drive! *You simply type TSAVE instead of SAVE and your computer stores any program on tape at lightning speed. What's even more amazing, any Turbosaved program can be loaded without the special TurboTape utility in the computer. Even after you've used TurboTape for weeks, you'll still find it hard to believe that your cassettes can save and load this fast. It works on any Commodore 64 or VIC-20. (At least 8K memory expansion is required to enter the program into the VIC.)*

There are very few absolute rules in computing, but one of them has always been that tape drives are inherently slower than disk drives. Long programs that take only seconds to load into the computer with a disk drive have always required many minutes of waiting with a tape drive.

Until now.

"TurboTape" rewrites the rules. It's a utility program that turbocharges tape saving, loading, and verifying on your Commodore 64 or VIC-20. It requires no modifications to your computer or tape drive. It works with BASIC programs and machine language programs. It's easy enough for anyone to use, including beginners. It even lets you load Turbosaved tapes at TurboTape speeds without using the utility. And it's yours for the typing after reading these instructions. (Next month we'll publish the technical details explaining how TurboTape seizes control of the computer and makes it perform these startling tricks.)

If you're still as skeptical as we were, try TurboTape. Try the speed tests mentioned at the end of this article. You'll find that TurboTape is everything it claims to be.

Typing TurboTape

TurboTape is written entirely in machine language. The BASIC programs presented here create a copy of TurboTape on either disk or tape. Be sure to type in the correct program for your computer (Program 1 for the Commodore 64 or Program 2 for the VIC-20). We recommend that you enter the program with "The Automatic Proofreader" found elsewhere in this issue and save the TurboTape generator before running it for the first time, since the program resets important memory pointers as it runs. That way, if a typing error causes your computer to lock up, you can reset the computer by turning it off then on again, and start checking for the typo.

Since the TurboTape data goes into the area of memory where BASIC programs normally reside, you'll need to reconfigure memory before loading and running the TurboTape generator programs. For the 64, type:

```
POKE 44,14:POKE 14*256,0:NEW
```

Then hit RETURN and load Program 1.

To use Program 2 on the VIC, you'll need at least 8K of memory expansion. Before loading the program, enter the following lines in direct mode (no line number), hitting RETURN after each line:

```
POKE 44,32:POKE 32*256,0:NEW
POKE 648,30:SYS 58648
```

Before running, check line 10. In both Programs 1 and 2, the contents of FI$ determines the name of the copy of TurboTape that will be created. Change this if you prefer a different name. Also, if you want to create your copy of TurboTape on disk instead of tape, change the D=1 in that line to D=8. Be sure that the tape or disk on which you wish TurboTape to be stored is in the drive before you run the generator program.

Once you have used the generator program to create a copy of TurboTape on tape or disk, you do not need the generator program again. The version of TurboTape you create (called

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TURBO/64 or TURBO/VIC, unless you change the names in line 10 of the generator programs) can be loaded and run like a BASIC program. It is not necessary to use the ,1 suffix (as in LOAD *"filename"*,8,1 or ,1,1) when loading TurboTape. Once created, VIC TurboTape can be loaded and run on a VIC with any memory configuration.

Easy To Use

Here are the main features of TurboTape:

- It will store itself safely out of the way of your normal BASIC programs.
- It protects any memory configurations you might be using. Only during the Turbosaving and Turboverifying is the Commodore 64's BASIC ROM exchanged for BASIC RAM. Following these operations, your previous configuration is restored.
- TurboTape can be used with other programming aids such as *Simons' BASIC, Supermon,* and *PAL.*
- TurboTape safely handles very large programs (up to 49K on the Commodore 64). However, some programs which barely fit into memory before may not fit when using TurboTape (it subtracts 639 bytes of available RAM from the VIC and 642 bytes from the 64).
- Filenames can be the usual 16 characters long.
- In addition to handling BASIC programs, TurboTape will save, load, or verify data from any part of RAM memory you wish, except for the RAM hidden beneath the Kernal ROM on the 64. RAM beneath the 64's BASIC ROM can even be saved.
- A normal LOAD command will load any Turbosaved program *at TurboTape speed.*

It's quite simple to use TurboTape. Reset your computer by turning it off, then on. If you want to use some additional utility like *Simons' BASIC,* load and run it first. Then type NEW.

Now load TurboTape and run it. In the 64 version, a menu will appear, offering you two optional memory locations for TurboTape:

1. In BASIC RAM. The ending address of the relocated TurboTape will be what's currently indicated as the limit of memory in the pointer in addresses 55 and 56. You may have to select this option if you want some utilities to coexist with TurboTape. *Simons' BASIC,* for example, is one. Any utility which makes use of the RAM between addresses 52606 and 53247 (for example, the "64 DOS Wedge") will require this option. (This is the only option possible on the VIC. The VIC version will always relocate to the top of memory.)

2. In the 4K RAM buffer. Using this option, you can Turbosave all RAM from 0 to 52606 in one huge block (including the RAM hidden behind BASIC ROM).

To get accustomed to using TurboTape, however, let's avoid combining it with other utilities for now. Simply turn on the computer, load TurboTape, and type RUN (don't attempt to edit the BASIC portion of TurboTape). For the 64, select option 2.

Sit Back And Be Amazed

You will now see on screen where TurboTape has been located and the commands you use to activate TurboTape's features. Then type NEW to remove the TurboTape loader from memory. Write a program or load one into the computer. To Turbosave this program, type:

TURBOSAVE *"filename"* [press RETURN]

(Or you can abbreviate TURBOSAVE as TSAVE.) You'll then see the usual message:

PRESS RECORD & PLAY

Press those keys, then sit back and be amazed.

A header containing a special Turboload routine is written to tape. (On the 64, the screen will blank while the header is written.) Then rainbowlike colors will vibrate on screen as your program is flashed onto the tape. Finally, your screen will return to normal.

If you want to verify the TSAVEd program, rewind the tape and type:

TURBOVERIFY *"filename"* [press RETURN]

(TURBOVERIFY can be abbreviated TVERIFY.) You'll see the normal message:

PRESS PLAY

Depress the PLAY key on the cassette drive. (On the 64, the screen will blank while the verification takes place.) If you should get an OUT OF MEMORY error message, simply type TVERIFY without a filename. As soon as the tape has passed the header, you get the usual message on screen. (For the 64, press the Commodore logo key.) If an error is found during TVERIFY, the screen will return to normal and you'll see the VERIFY ERROR message. If you're interested in knowing precisely where a mismatch was found, type:

?PEEK(172)+256*PEEK(173)

If there was no problem during the TVERIFY, you'll see the message: VERIFY OK.

Lightning LOADs

You won't need the TurboTape utility to load programs which have been Turbosaved. Just type LOAD normally and everything will happen as it always does, except the program will zoom into your computer.

Here are a few additional notes about TurboTape. To save machine language programs, you'll need to specify the starting and ending addresses. For example, if your machine language program resides in memory from 864 to 890, save it in the following fashion:

TSAVE"MACHINE PROGRAM",864,891

Notice that you must use the ending address *plus one*. To save the entire contents of RAM on a 64, including the RAM hidden behind BASIC ROM, type:

TSAVE"ALL RAM",2049,52606

Most other programming utilities work well with TurboTape. If you use *Simons' BASIC*, however, you should avoid the RUN/STOP–RESTORE combination, and the COLD command has no effect. If you're also using the DOS wedge, choose option 1 to locate TurboTape into BASIC RAM memory to avoid conflicts on the 64.

Because of the high speeds, you might want to use only high-quality cassettes for reliable storage. TurboTape, like the normal SAVE/LOAD, will sometimes be unable to Turboload if a program was TSAVEd using a different cassette drive. This happens when a recording head on one of the drives is out of alignment. For very important programs, you may want to make a backup copy with the normal SAVE command. Although the standard SAVE is much slower, it is extremely reliable.

Another reason for making backup copies with the normal SAVE is that 64s cannot read tapes created by VIC TurboTape, and vice versa. This is a result of differences in the Turboload machine language routine, which we'll discuss next month.

You should use LOAD and the TurboTape commands only in direct mode, not from within a running program. Also, TurboTape cannot search through several files on a cassette in search of a certain filename. If you have several Turbosaved programs on a tape, you should fast-forward past any Turbosaved programs you don't wish to load. Use the cassette drive's counter for this purpose.

No Turbosaved program will relocate itself upon loading. The address in RAM memory from which you Turbosaved will be the address where the program will later load. In effect, all Turbosaved programs act as if you're using the nonrelocating command: LOAD *"filename"*,1,1. This is especially important if you're a VIC owner who uses several different memory configurations. For example, a BASIC program Turbosaved on an expanded VIC will not load normally into an unexpanded VIC.

How Fast Is It?

Tests here revealed that a 12K program took 34 seconds to load with a 1541 disk drive and 44 seconds to load with TurboTape. However, the TurboTape load time was actually only 28 seconds once the program header was located on the tape. We ran these tests by timing TurboTape with a completely rewound cassette, presuming that most people do not position the tape so that a program header is right in front of the tape head. If you do position your tapes exactly with the tape counter, TurboTape will indeed load programs faster than a 1541 disk drive.

Turbosaving the 12K program took 42 seconds; the 1541 disk drive took 40 seconds. Turboverify and disk verify took the same amount of time as loading a program.

TurboTape is one of the most interesting and useful utilities a cassette owner can possess. The story behind the TurboTape technique is fascinating as well. If you're interested in how TurboTape does its magic, look for "How TurboTape Works" next month in COMPUTE!.

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing these programs in.

Program 1: TurboTape Generator For Commodore 64

```
10 FI$="TURBO/64":D=1:REM CHANGE 1 TO 8 F
   OR DISK                        :rem 136
20 PRINT "{CLR}{3 DOWN}"TAB(11)"ENTERING
   {SPACE}TURBOTAPE{3 DOWN}"       :rem 12
30 FOR I=2049 TO 3461              :rem 16
40 READ A:POKE I,A:CK=CK+A:NEXT    :rem 88
50 IF CK<>143099 THEN PRINT "{2 SPACES}
   {RVS}ERROR DETECTED IN DATA STATEMENTS
   !":STOP                        :rem 110
60 PRINTTAB(16)"{RVS}DATA OK{3 DOWN}":PRI
   NTTAB(4)"PRESS ANY KEY WHEN READY TO S
   AVE"                           :rem 253
70 GET A$:IF A$="" THEN 70        :rem 241
80 PRINT "{CLR}POKE 43,1:POKE 44,8:POKE 4
   5,134:POKE 46,13{2 DOWN}"       :rem 15
90 PRINT"SAVE"CHR$(34);FI$;CHR$(34);",";D
                                   :rem 46
100 POKE 631,19:POKE 632,13:POKE 633,13:P
    OKE 198,3:END                 :rem 148
2049 DATA 62,8,100,0,153,34        :rem 38
2055 DATA 147,17,17,17,34,163     :rem 151
2061 DATA 49,50,41,34,18,32        :rem 43
2067 DATA 84,85,82,66,79,83        :rem 79
2073 DATA 65,86,69,47,76,79        :rem 82
2079 DATA 65,68,32,146,17,17      :rem 113
2085 DATA 17,17,34,58,153,34      :rem 105
2091 DATA 32,32,32,32,82,69        :rem 47
2097 DATA 76,79,67,65,84,69        :rem 88
2103 DATA 32,84,79,58,17,17        :rem 58
2109 DATA 0,140,8,110,0,153        :rem 26
2115 DATA 34,32,32,32,32,32        :rem 31
2121 DATA 32,32,49,46,32,66        :rem 46
2127 DATA 65,83,73,67,32,82        :rem 62
2133 DATA 65,77,32,40,80,79        :rem 57
2139 DATA 73,78,84,69,82,32        :rem 72
2145 DATA 53,53,47,53,54,41        :rem 51
2151 DATA 17,34,58,153,34,32       :rem 96
2157 DATA 32,32,32,32,32,32        :rem 35
2163 DATA 50,46,32,70,82,79        :rem 55
```

```
2169 DATA 77,32,53,50,54,48          :rem 61
2175 DATA 54,32,84,48,32,53          :rem 56
2181 DATA 51,50,52,56,17,17          :rem 47
2187 DATA 0,199,8,120,0,151          :rem 45
2193 DATA 49,55,49,44,48,58          :rem 74
2199 DATA 133,34,32,32,32,32         :rem 93
2205 DATA 89,79,85,82,32,67          :rem 73
2211 DATA 72,79,73,67,69,32          :rem 64
2217 DATA 40,49,47,50,41,34          :rem 47
2223 DATA 59,65,36,58,139,65        :rem 118
2229 DATA 36,178,34,49,34,167       :rem 167
2235 DATA 151,49,55,49,44,49        :rem 114
2241 DATA 58,137,49,52,48,0          :rem 55
2247 DATA 216,8,130,0,139,65         :rem 98
2253 DATA 36,179,177,34,50,34       :rem 158
2259 DATA 167,49,50,48,0,245        :rem 111
2265 DATA 8,140,0,158,40,194         :rem 98
2271 DATA 40,52,53,41,170,50         :rem 87
2277 DATA 53,54,172,194,40,52       :rem 156
2283 DATA 54,41,171,56,49,50        :rem 105
2289 DATA 41,58,156,0,62,9           :rem 10
2295 DATA 150,0,153,34,147,17       :rem 146
2301 DATA 17,17,32,32,32,32          :rem 32
2307 DATA 78,79,87,32,76,79          :rem 82
2313 DATA 67,65,84,69,68,32          :rem 69
2319 DATA 65,84,58,34,194,40        :rem 114
2325 DATA 49,57,51,41,170,50         :rem 99
2331 DATA 53,54,172,194,40,49       :rem 153
2337 DATA 57,52,41,34,45,34          :rem 52
2343 DATA 194,40,49,55,52,41        :rem 103
2349 DATA 170,50,53,54,172,194      :rem 206
2355 DATA 40,49,55,53,41,34          :rem 52
2361 DATA 17,17,17,17,0,128          :rem 45
2367 DATA 9,160,0,78,36,178          :rem 64
2373 DATA 199,40,51,52,41,170       :rem 150
2379 DATA 34,78,65,77,69,34          :rem 80
2385 DATA 170,199,40,51,52,41       :rem 153
2391 DATA 58,80,36,178,78,36        :rem 123
2397 DATA 170,34,91,44,66,65        :rem 115
2403 DATA 44,69,65,93,34,58          :rem 65
2409 DATA 90,83,36,178,34,32        :rem 110
2415 DATA 32,79,82,32,83,89          :rem 66
2421 DATA 83,40,54,56,48,41          :rem 51
2427 DATA 34,170,80,36,0,195        :rem 100
2433 DATA 9,170,0,90,86,36            :rem 3
2439 DATA 178,34,32,32,79,82        :rem 115
2445 DATA 32,83,89,83,40,54          :rem 62
2451 DATA 56,51,41,34,170,78        :rem 102
2457 DATA 36,58,84,83,36,178        :rem 126
2463 DATA 34,84,85,82,66,79          :rem 75
2469 DATA 83,65,86,69,34,170        :rem 125
2475 DATA 80,36,58,84,86,36          :rem 73
2481 DATA 178,34,84,85,82,66        :rem 123
2487 DATA 79,86,69,82,73,70          :rem 83
2493 DATA 89,34,170,78,36,0          :rem 64
2499 DATA 239,9,180,0,153,34        :rem 110
2505 DATA 32,32,84,79,32,83          :rem 56
2511 DATA 65,86,69,58,32,34          :rem 64
2517 DATA 84,83,36,58,153,34        :rem 114
2523 DATA 32,32,163,163,163,163     :rem 244
2529 DATA 163,163,163,34,58,153       :rem 3
2535 DATA 44,90,83,36,34,17          :rem 57
2541 DATA 17,0,31,10,190,0          :rem 233
2547 DATA 153,34,32,32,84,79        :rem 110
2553 DATA 32,86,69,82,73,70          :rem 66
2559 DATA 89,58,32,34,84,86          :rem 79
2565 DATA 36,58,153,34,32,32        :rem 104
2571 DATA 163,163,163,163,163,163 :rem 97
2577 DATA 163,163,163,34,58,153       :rem 6
2583 DATA 44,90,86,36,34,17          :rem 63
2589 DATA 17,0,88,10,200,0          :rem 249
2595 DATA 153,34,32,32,84,79        :rem 113
```

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2601 DATA 32,76,79,65,68,58          :rem 71
2607 DATA 32,76,79,65,68,32          :rem 69
2613 DATA 40,84,85,82,66,79          :rem 69
2619 DATA 32,78,79,84,32,78          :rem 76
2625 DATA 69,67,69,83,83,65          :rem 81
2631 DATA 82,89,41,34,58,153        :rem 111
2637 DATA 34,32,32,163,163,163      :rem 199
2643 DATA 163,163,163,163,0,0       :rem 141
2649 DATA 0,56,165,45,133,90        :rem 107
2655 DATA 233,130,133,95,165,46     :rem 255
2661 DATA 133,91,233,2,133,96       :rem 150
2667 DATA 165,171,208,6,169,0       :rem 160
2673 DATA 162,208,208,4,165,55      :rem 207
2679 DATA 166,56,133,88,133,174      :rem 16
2685 DATA 134,89,134,175,32,191       :rem 9
2691 DATA 163,230,89,165,88,166      :rem 17
2697 DATA 89,133,193,134,194,172     :rem 67
2703 DATA 0,3,140,166,2,172          :rem 35
2709 DATA 1,3,140,167,2,141          :rem 39
2715 DATA 0,3,142,1,3,164           :rem 190
2721 DATA 171,240,4,133,55,134      :rem 190
2727 DATA 56,162,255,32,142,251     :rem 252
2733 DATA 32,219,252,32,219,252     :rem 249
2739 DATA 32,209,252,176,75,160       :rem 5
2745 DATA 0,177,172,201,190,208     :rem 248
2751 DATA 240,232,169,32,224,6      :rem 197
2757 DATA 240,13,224,7,208,2         :rem 96
2763 DATA 169,157,224,11,208,5      :rem 206
2769 DATA 169,189,44,169,162,145     :rem 75
2775 DATA 172,200,24,177,172,101     :rem 40
2781 DATA 193,145,172,8,200,177       :rem 2
2787 DATA 172,201,160,240,249,40     :rem 43
2793 DATA 101,194,145,172,224,4     :rem 251
2799 DATA 176,188,157,170,2,232      :rem 14
2805 DATA 136,177,172,157,168,2       :rem 6
2811 DATA 232,169,76,157,166,2      :rem 210
2817 DATA 208,170,96,32,121,0       :rem 146
2823 DATA 168,32,115,0,192,148      :rem 201
2829 DATA 208,8,190,104,0,208       :rem 150
2835 DATA 10,108,166,2,192,149      :rem 203
2841 DATA 208,249,190,31,0,162      :rem 197
2847 DATA 128,108,166,2,169,0       :rem 158
2853 DATA 133,10,32,212,225,169     :rem 243
2859 DATA 0,32,213,255,176,56       :rem 158
2865 DATA 162,209,142,165,3,202     :rem 249
2871 DATA 142,167,3,169,96,141      :rem 213
2877 DATA 209,3,32,81,3,8           :rem 213
2883 DATA 169,145,32,210,255,32     :rem 254
2889 DATA 216,245,40,208,8,32       :rem 160
2895 DATA 209,252,144,3,76,141      :rem 209
2901 DATA 225,162,28,76,55,164      :rem 208
2907 DATA 32,14,226,32,138,173      :rem 200
2913 DATA 32,247,183,165,20,166     :rem 254
2919 DATA 21,96,76,249,224,169      :rem 225
2925 DATA 188,190,200,160,1,32      :rem 194
2931 DATA 189,255,169,1,170,168      :rem 11
2937 DATA 32,186,255,134,171,32       :rem 1
2943 DATA 121,0,201,34,208,32       :rem 133
2949 DATA 136,230,122,177,122,240 :rem 92
2955 DATA 4,201,34,208,8,198        :rem 109
2961 DATA 171,165,171,208,240,169:rem 102
2967 DATA 32,190,199,1,232,224      :rem 208
2973 DATA 17,144,242,32,121,0       :rem 141
2979 DATA 240,86,169,34,32,255      :rem 221
2985 DATA 174,240,79,190,87,0       :rem 169
2991 DATA 133,78,134,79,190,87      :rem 226
2997 DATA 0,133,80,134,81,190       :rem 155
3003 DATA 10,1,176,230,162,9         :rem 83
3009 DATA 190,237,0,157,44,3         :rem 96
3015 DATA 202,16,247,162,44,160     :rem 239
3021 DATA 3,134,193,132,194,162     :rem 241
3027 DATA 60,134,174,132,175,70     :rem 246
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3033 DATA 157,32,237,245,8,32      :rem 149
3039 DATA 21,253,6,157,40,176      :rem 151
3045 DATA 131,169,16,133,183,32    :rem 246
3051 DATA 147,246,190,19,1,96      :rem 155
3057 DATA 46,3,165,1,9,48          :rem 212
3063 DATA 133,139,208,27,160,3     :rem 195
3069 DATA 185,43,0,153,78,0         :rem 53
3075 DATA 136,16,247,48,183,230      :rem 0
3081 DATA 78,208,2,230,79,165      :rem 158
3087 DATA 78,197,80,165,79,229     :rem 233
3093 DATA 81,96,88,162,0,160       :rem 109
3099 DATA 0,132,192,173,17,208     :rem 202
3105 DATA 41,239,141,17,208,165    :rem 246
3111 DATA 1,133,139,41,254,133     :rem 184
3117 DATA 1,202,208,253,136,208    :rem 239
3123 DATA 250,120,132,83,169,2     :rem 188
3129 DATA 190,138,1,198,83,208     :rem 211
3135 DATA 247,169,9,133,83,165     :rem 214
3141 DATA 83,190,138,1,198,83      :rem 158
3147 DATA 208,247,165,78,190,138    :rem 61
3153 DATA 1,165,79,190,141,1        :rem 96
3159 DATA 165,80,190,141,1,165     :rem 201
3165 DATA 81,190,141,1,162,4        :rem 92
3171 DATA 190,134,1,132,171,177    :rem 243
3177 DATA 78,190,146,1,190,4       :rem 107
3183 DATA 1,144,246,234,165,171    :rem 249
3189 DATA 190,146,1,190,141,1      :rem 146
3195 DATA 140,160,2,32,147,252     :rem 192
3201 DATA 165,139,9,48,133,1        :rem 98
3207 DATA 133,192,96,202,208,253    :rem 44
3213 DATA 96,162,3,44,162,5         :rem 48
3219 DATA 190,134,1,133,189,24     :rem 199
3225 DATA 101,171,133,171,169,8    :rem 245
3231 DATA 133,164,190,190,1,166    :rem 243
3237 DATA 163,202,208,253,190,190 :rem 91
3243 DATA 1,70,189,162,13,144      :rem 146
3249 DATA 2,162,41,134,163,198     :rem 204
3255 DATA 164,240,17,162,9,190     :rem 202
3261 DATA 134,1,234,240,223,165    :rem 237
3267 DATA 1,73,8,133,1,238           :rem 0
3273 DATA 32,208,96,32,32,32        :rem 98
3279 DATA 32,32,32,32,32,32         :rem 41
3285 DATA 32,32,32,32,32,32         :rem 38
3291 DATA 32,173,17,208,41,239     :rem 202
3297 DATA 141,17,208,32,21,253     :rem 197
3303 DATA 200,132,192,169,54,133    :rem 35
3309 DATA 1,202,208,253,136,208    :rem 242
3315 DATA 250,120,169,248,141,6    :rem 246
3321 DATA 221,32,228,3,102,189     :rem 189
3327 DATA 169,2,197,189,208,245     :rem 15
3333 DATA 133,123,160,9,32,212     :rem 185
3339 DATA 3,201,2,240,249,196      :rem 149
3345 DATA 189,208,230,32,212,3     :rem 195
3351 DATA 136,208,246,133,172,32    :rem 40
3357 DATA 212,3,133,173,32,212     :rem 188
3363 DATA 3,133,174,32,212,3        :rem 88
3369 DATA 133,175,132,171,32,212    :rem 40
3375 DATA 3,145,172,36,16,24       :rem 101
3381 DATA 101,171,133,171,32,219    :rem 33
3387 DATA 252,32,209,252,144,236    :rem 49
3393 DATA 32,212,3,140,160,2        :rem 83
3399 DATA 32,147,252,165,139,133    :rem 56
3405 DATA 1,88,133,192,32,170      :rem 147
3411 DATA 245,134,45,132,46,165    :rem 247
3417 DATA 189,197,171,76,154,225    :rem 65
3423 DATA 169,8,133,163,32,228     :rem 204
3429 DATA 3,102,189,198,163,208      :rem 6
3435 DATA 247,165,189,96,169,16     :rem 22
3441 DATA 44,13,220,240,251,173    :rem 235
3447 DATA 13,221,142,7,221,72      :rem 141
3453 DATA 169,25,141,15,221,104    :rem 242
3459 DATA 74,74,96                 :rem 140
```

Program 2: TurboTape Generator For VIC-20

Translation by Ottis Cowper, Technical Editor

```
10 FI$="TURBO/VIC":D=1:REM FOR DISK CHANG
   E 1 TO 8                           :rem 0
20 PRINT "{CLR}{4 DOWN}{2 SPACES}ENTERING
    TURBOTAPE{5 DOWN}"              :rem 113
30 FOR I=4097 TO 5260                :rem 20
40 READ A:POKE I,A:CK=CK+A:NEXT      :rem 88
50 IF CK<>123374 THEN PRINT "{RVS}ERROR D
   ETECTED IN DATA STATEMENTS":STOP
                                     :rem 71
60 PRINTTAB(7)"{RVS}DATA OK{2 DOWN}":PRIN
   T"PRESS ANY KEY TO SAVE"         :rem 185
70 GET A$:IF A$=""THEN 70           :rem 241
80 PRINT"{CLR}POKE 43,1:POKE 44,16:POKE 4
   5,141:POKE 46,20{2 DOWN}"         :rem 58
90 PRINT"SAVE"CHR$(34);FI$;CHR$(34);","D
                                    :rem 243
100 POKE 631,19:POKE 632,13:POKE 633,13:P
    OKE 198,3:END                   :rem 148
4097 DATA 32,16,100,0,153,34         :rem 87
4103 DATA 147,32,32,32,144,18       :rem 139
4109 DATA 32,84,85,82,66,79          :rem 72
4115 DATA 83,65,86,69,47,76          :rem 76
4121 DATA 79,65,68,32,31,17          :rem 56
4127 DATA 0,61,16,110,0,158          :rem 34
4133 DATA 40,194,40,52,53,41         :rem 91
4139 DATA 170,50,53,54,172,194      :rem 205
4145 DATA 40,52,54,41,171,55         :rem 96
4151 DATA 57,53,41,58,156,0          :rem 51
4157 DATA 112,16,120,0,153,34       :rem 133
4163 DATA 78,79,87,32,65,84          :rem 78
4169 DATA 34,194,40,49,57,51        :rem 114
4175 DATA 41,170,50,53,54,172       :rem 148
4181 DATA 194,40,49,57,52,41        :rem 107
4187 DATA 34,45,34,194,40,49        :rem 112
4193 DATA 55,52,41,170,50,53         :rem 98
4199 DATA 54,172,194,40,49,55       :rem 169
4205 DATA 53,41,0,155,16,130         :rem 84
4211 DATA 0,78,36,178,199,40        :rem 109
4217 DATA 51,52,41,170,34,78        :rem 100
4223 DATA 65,77,69,34,170,199       :rem 171
4229 DATA 40,51,52,41,58,79          :rem 58
4235 DATA 80,36,178,78,36,170       :rem 165
4241 DATA 34,91,44,66,65,44          :rem 57
4247 DATA 69,65,93,0,229,16          :rem 65
4253 DATA 140,0,90,83,36,178        :rem 102
4259 DATA 34,83,89,83,40,54          :rem 69
4265 DATA 56,48,41,34,170,79        :rem 114
4271 DATA 80,36,58,90,86,36          :rem 66
4277 DATA 178,34,83,89,83,40        :rem 124
4283 DATA 54,56,51,41,34,170        :rem 101
4289 DATA 78,36,58,84,83,36          :rem 82
4295 DATA 178,34,84,83,65,86        :rem 129
4301 DATA 69,34,170,79,80,36        :rem 109
4307 DATA 58,84,86,36,178,34        :rem 123
4313 DATA 84,86,69,82,73,70          :rem 69
4319 DATA 89,34,170,78,36,0          :rem 63
4325 DATA 11,17,150,0,153,34         :rem 84
4331 DATA 17,144,18,84,79,32        :rem 108
4337 DATA 83,65,86,69,58,31          :rem 75
4343 DATA 17,34,58,153,84,83        :rem 112
4349 DATA 36,44,34,32,32,79          :rem 60
4355 DATA 82,34,58,153,90,83        :rem 114
4361 DATA 36,0,50,17,160,0          :rem 241
4367 DATA 153,34,144,18,84,79       :rem 168
4373 DATA 32,86,69,82,73,70          :rem 68
4379 DATA 89,58,31,17,34,58          :rem 75
4385 DATA 153,84,86,36,44,34        :rem 117
4391 DATA 32,32,79,82,34,58          :rem 63
```

```
4397 DATA 153,90,86,36,0,112       :rem 106
4403 DATA 17,170,0,153,34,17        :rem 89
4409 DATA 144,18,84,79,32,76       :rem 119
4415 DATA 79,65,68,58,31,17         :rem 70
4421 DATA 34,58,153,34,76,79       :rem 114
4427 DATA 65,68,32,79,82,32         :rem 68
4433 DATA 76,79,65,68,34,78         :rem 80
4439 DATA 36,44,34,32,40,84         :rem 55
4445 DATA 85,82,66,79,32,78         :rem 78
4451 DATA 79,84,32,82,69,81         :rem 71
4457 DATA 85,73,82,69,68,41         :rem 77
4463 DATA 0,0,0,56,165,45          :rem 199
4469 DATA 133,90,233,127,133,95      :rem 4
4475 DATA 165,46,133,91,233,2      :rem 155
4481 DATA 133,96,165,55,133,88     :rem 218
4487 DATA 133,174,166,56,134,89     :rem 17
4493 DATA 134,175,32,191,195,230    :rem 51
4499 DATA 89,165,88,166,89,133     :rem 242
4505 DATA 193,134,194,172,0,3      :rem 148
4511 DATA 140,166,2,172,1,3         :rem 35
4517 DATA 140,167,2,141,0,3         :rem 37
4523 DATA 142,1,3,133,55,134        :rem 88
4529 DATA 56,162,255,32,210,251    :rem 250
4535 DATA 32,27,253,32,27,253      :rem 151
4541 DATA 32,17,253,176,75,160     :rem 204
4547 DATA 0,177,172,201,190,208    :rem 250
4553 DATA 240,232,169,32,224,6     :rem 199
4559 DATA 240,13,224,7,208,2        :rem 98
4565 DATA 169,157,224,11,208,5     :rem 208
4571 DATA 169,189,46,169,162,145    :rem 70
4577 DATA 172,200,24,177,172,101    :rem 42
4583 DATA 193,145,172,8,200,177      :rem 4
4589 DATA 172,201,160,240,249,40    :rem 45
4595 DATA 101,194,145,172,224,4    :rem 253
4601 DATA 176,188,157,170,2,232    :rem 254
4607 DATA 136,177,172,157,168,2      :rem 8
4613 DATA 232,169,76,157,166,2     :rem 212
4619 DATA 208,170,96,32,121,0      :rem 148
4625 DATA 168,32,115,0,192,148     :rem 203
4631 DATA 208,8,190,102,0,208      :rem 141
4637 DATA 10,108,166,2,192,149     :rem 205
4643 DATA 208,249,190,29,0,76      :rem 162
4649 DATA 116,196,169,0,133,10     :rem 205
4655 DATA 32,209,225,169,0,32      :rem 152
4661 DATA 213,255,176,56,162,209    :rem 54
4667 DATA 142,161,3,202,142,163    :rem 244
4673 DATA 3,169,96,141,206,3       :rem 109
4679 DATA 32,81,3,8,169,145         :rem 67
4685 DATA 32,210,255,32,112,246    :rem 246
4691 DATA 40,208,8,32,17,253       :rem 103
4697 DATA 144,3,76,141,225,162     :rem 209
4703 DATA 28,76,55,196,32,11       :rem 108
4709 DATA 226,32,138,205,32,247    :rem 254
4715 DATA 215,165,20,166,21,96     :rem 204
4721 DATA 76,246,224,169,183,190    :rem 59
4727 DATA 202,160,1,32,189,255     :rem 201
4733 DATA 169,1,170,168,32,186     :rem 211
4739 DATA 255,134,171,32,121,0     :rem 195
4745 DATA 201,34,208,32,136,230    :rem 242
4751 DATA 122,177,122,240,4,201    :rem 237
4757 DATA 34,208,8,198,171,165     :rem 221
4763 DATA 171,208,240,169,32,190    :rem 50
4769 DATA 201,1,232,224,17,144     :rem 196
4775 DATA 242,32,121,0,240,90      :rem 141
4781 DATA 169,34,32,255,206,240      :rem 0
4787 DATA 83,190,85,0,133,78       :rem 120
4793 DATA 134,79,190,85,0,133      :rem 163
4799 DATA 80,134,81,190,12,1       :rem 106
4805 DATA 176,230,162,13,190,235    :rem 43
4811 DATA 0,157,44,3,202,16         :rem 39
4817 DATA 247,162,44,160,3,134     :rem 202
4823 DATA 193,132,194,162,60,134    :rem 47
```

```
4829 DATA 174,132,175,70,157,32      :rem 5
4835 DATA 133,246,8,32,138,255     :rem 210
4841 DATA 6,157,40,176,131,169     :rem 209
4847 DATA 16,133,183,32,44,247     :rem 209
4853 DATA 190,21,1,96,46,3           :rem 4
4859 DATA 173,28,145,133,139,9     :rem 220
4865 DATA 12,141,28,145,208,23     :rem 201
4871 DATA 160,3,185,43,0,153        :rem 98
4877 DATA 78,0,136,16,247,48       :rem 121
4883 DATA 179,230,78,208,2,230     :rem 211
4889 DATA 79,165,78,197,80,165     :rem 243
4895 DATA 79,229,81,96,88,162      :rem 190
4901 DATA 0,160,0,132,192,173      :rem 136
4907 DATA 28,145,133,139,9,12      :rem 158
4913 DATA 141,28,145,202,208,253    :rem 41
4919 DATA 136,208,250,120,132,83    :rem 44
4925 DATA 169,2,190,138,1,198      :rem 165
4931 DATA 83,208,247,169,9,133     :rem 217
4937 DATA 83,165,83,190,138,1      :rem 166
4943 DATA 198,83,208,247,165,78     :rem 25
4949 DATA 190,138,1,165,79,190     :rem 221
4955 DATA 141,1,165,80,190,141     :rem 200
4961 DATA 1,165,81,190,141,1        :rem 97
4967 DATA 162,4,190,134,1,132      :rem 150
4973 DATA 171,177,78,190,146,1     :rem 218
4979 DATA 190,6,1,144,246,234      :rem 162
4985 DATA 165,171,190,146,1,190      :rem 5
4991 DATA 141,1,140,160,2,32        :rem 87
4997 DATA 207,252,165,139,141,28    :rem 62
5003 DATA 145,133,192,169,27,141    :rem 42
5009 DATA 15,144,96,202,208,253    :rem 250
5015 DATA 96,162,3,44,162,5         :rem 50
5021 DATA 190,134,1,133,189,24     :rem 192
5027 DATA 101,171,133,171,169,8    :rem 247
5033 DATA 133,164,190,190,1,166    :rem 245
5039 DATA 163,202,208,253,190,190  :rem 93
5045 DATA 1,70,189,162,13,144      :rem 148
5051 DATA 2,162,41,134,163,198     :rem 197
5057 DATA 164,240,19,162,9,190     :rem 206
5063 DATA 134,1,234,240,223,173    :rem 238
5069 DATA 32,145,73,8,141,32       :rem 102
5075 DATA 145,141,15,144,96,32     :rem 202
5081 DATA 32,32,32,32,32,32         :rem 34
5087 DATA 32,32,32,32,32,32         :rem 40
5093 DATA 32,32,32,32,138,255      :rem 147
5099 DATA 200,132,192,202,208,253  :rem 89
5105 DATA 136,208,250,120,173,27    :rem 35
5111 DATA 145,41,63,141,27,145     :rem 191
5117 DATA 169,248,141,22,145,32    :rem 251
5123 DATA 225,3,102,189,169,2      :rem 148
5129 DATA 197,189,208,245,133,123:rem 108
5135 DATA 160,9,32,209,3,201        :rem 90
5141 DATA 2,240,249,196,189,208      :rem 4
5147 DATA 230,32,209,3,136,208     :rem 195
5153 DATA 246,133,172,32,209,3     :rem 196
5159 DATA 133,173,32,209,3,133     :rem 198
5165 DATA 174,32,209,3,133,175     :rem 202
5171 DATA 132,171,32,209,3,145     :rem 192
5177 DATA 172,36,16,24,101,171     :rem 197
5183 DATA 133,171,32,27,253,32     :rem 196
5189 DATA 17,253,144,236,32,209      :rem 3
5195 DATA 3,140,160,2,32,207        :rem 89
5201 DATA 252,165,139,141,28,145    :rem 42
5207 DATA 88,133,192,32,66,246     :rem 212
5213 DATA 134,45,132,46,165,189      :rem 0
5219 DATA 197,171,76,154,225,169    :rem 65
5225 DATA 8,133,163,32,225,3        :rem 94
5231 DATA 102,189,198,163,208,247:rem 105
5237 DATA 165,189,96,169,2,44      :rem 174
5243 DATA 45,145,240,251,173,29    :rem 251
5249 DATA 145,72,173,33,145,142    :rem 255
5255 DATA 21,145,104,10,10,96    :rem 138 ©
```

Enhanced Applesoft INPUT

Dale W. Woolridge

Here's a way to make your APPLE II-family computer a little smarter and friendlier. The short routine is written in machine language, but you don't have to be an ML programmer to use it.

The loan-repayment program running on my Apple asked me a simple question:

HOW MANY MONTHLY PAYMENTS?

The loan was for 17 years, with 12 payments per year. So there I was, seated before a computer system that cost several thousand dollars, doing mental arithmetic! How nice it you could just enter the expression 17*12.

Apple users will guess that the Applesoft INPUT command was responsible for asking the question. It's one of the most useful commands in BASIC; it prints a prompt, waits for you to respond, and then stores your answer for future use.

Unfortunately, the INPUT command has some features that can be inconvenient—such as its inability to accept even simple mathematical expressions. So I wrote a program that adds a new command, &INPUT, to Applesoft. The syntax for &INPUT is almost the same as for INPUT, but its features are different.

A Few Improvements

If &INPUT is used with a numeric variable, you may enter any valid numeric expression. *Numeric expression* means anything that could legally appear to the right of the equals sign in a numeric assignment (LET) statement. &INPUT evaluates the expression and stores the result.

For example, if a program contains the lines:

```
100 PI = 3.1415926
110  &  INPUT "GIVE ME A NUMERIC EXPRES
     SION ";A
120  PRINT "ITS VALUE IS ";A
```

you may enter something like:

SQR(PI)+PDL(0)+PEEK(127)

The PRINT statement in line 120 will show that the value of your expression is in A.

Unlike INPUT, &INPUT interprets a null expression (just pressing RETURN) as the value zero. &INPUT is smart enough to know where a numeric expression ends and a comment (or garbage) begins. If you enter something like 45 YEARS the &INPUT command knows that you really meant 45. INPUT would give you a REENTER message.

&INPUT may also be used with a string variable. Your input string may contain commas, quotes, or colons. The regular INPUT command is somewhat neurotic about these characters, in my opinion. Curiously, INPUT won't accept leading spaces in an input string, either. If you enter three spaces and a character, say, it interprets your input to be only one character long.

But the improved &INPUT accepts the leading spaces as part of the string.

&INPUT treats most escape and control characters as INPUT does; however, it treats CTRL-C differently. If you enter CTRL-C as your input, &INPUT gives you a BREAK message, like INPUT. But then you can PRINT and change the values of any variables in your program and resume program execution with the CONT command. The variable in the &INPUT statement retains its previous value, unless you changed it in immediate mode.

One feature missing from &INPUT is the multiple variable function available with INPUT. A statement such as:

```
200 &INPUT "X,Y COORDINATES? ";X,Y
```

will not work, although the comparable INPUT statement would work.

How To Use &INPUT

The program is listed as a *hex dump*—a list of hexadecimal numbers which you can enter directly into the computer's memory with the Apple's built-in machine language monitor. You *don't* need to be a machine language programmer. Just enter the monitor by typing CALL −151 and pressing RETURN. An asterisk will appear on the screen. The * is the prompt for the monitor, similar to the bracket in BASIC.

Next, type 300.3AF after the asterisk and press RETURN. A hex dump appears on the screen. You have to replace those numbers with the new numbers in the program listing.

Starting with the first line, type 300: after the asterisk, then enter the first eight numbers. Press RETURN at the end of the line. Continue until the entire program is entered.

When you've checked that all your typing is correct, save the program to disk with this command:

```
BSAVE AMPER-INPUT,A$300,L$B0
```

Then exit the monitor by pressing the RESET button. To load, run, and initialize the program, simply type:

```
BRUN AMPER-INPUT
```

Program 1: Enhanced Applesoft INPUT—Hex Dump

```
0300- A0 02 B9 0C 03 99 F5 03
0308- 88 10 F7 60 4C 0F 03 C9
0310- 84 F0 05 A2 10 4C 12 D4
0318- 20 B1 00 C9 22 F0 06 20
0320- 5A DB 4C 30 03 20 81 DE
0328- A9 3B 20 C0 DE 20 3D DB
0330- 20 E3 DF 85 85 84 86 24
0338- 11 70 42 A5 B8 A4 B9 8D
0340- AE 03 8C AF 03 20 2C D5
0348- AD 00 02 D0 0C A9 30 8D
0350- 00 02 A9 00 8D 01 02 F0
0358- 0E C9 03 D0 03 4C 63 D8
0360- A9 00 85 B8 20 59 D5 A9
0368- 00 85 B8 A9 02 85 B9 20
0370- 52 DA AD AE 03 AC AF 03
0378- 85 B8 84 B9 60 20 2C D5
0380- AD 00 02 C9 03 D0 03 4C
0388- 63 D8 E8 BD 00 02 D0 FA
0390- 8E AD 03 8A 20 52 E4 A0
0398- 00 91 83 C8 A5 71 91 83
03A0- C8 A5 72 91 83 A2 00 AD
03A8- AD 03 4C E2 E5 00 00 00
```

Program 2: Enhanced Applesoft INPUT—Source Listing

```
131 000 *--------------------------------
1010 *                AMPER-INPUT
1020 *--------------------------------
1030            .OR $300        DECIMAL 768
1040 VALTYP .EQ $0011      $00=NUMBER, $FF=STRING
1050 FRESPC .EQ $0071      PTR TO STRING (OBTAINED BY GETSPA)
1060 VARPNT .EQ $0083      PTR TO STRING DESCRIPTOR
1070 FORPNT .EQ $0085      PTR TO ADDR IN VAR TABLE
1080 CHRGET .EQ $00B1      GET NEXT CHAR, UPDATE TXTPTR
1090 TXTPTR .EQ $00B8      ADDR OF CHAR IN TEXT
1100 BUF    .EQ $0200      KEYBOARD BUFFER
1110 AMPERV .EQ $03F5      AMPERSAND VECTOR
1120 ERROR  .EQ $D412      APPLESOFT ERROR ROUTINE
1130 INLIN  .EQ $D52C      APPLESOFT LINE INPUT
1140 TOKEN  .EQ $D559      APPLESOFT TOKENIZER
1150 BREAK  .EQ $D863      BREAK IN LINE...
1160 LET1   .EQ $DA52      EVALUATE EXPRESSION
1170 STRPRT .EQ $DB3D      PRINT A STRING
1180 OUTQST .EQ $DB5A      PRINT A ?
1190 STRTXT .EQ $DE81      PREPARE STRING
1200 SYNCHR .EQ $DEC0      SYNTAX CHARACTER CHECK
1210 PTRGET .EQ $DFE3      FIND ADDR OF VAR IN TABLE
1220 GETSPA .EQ $E452      GET SPACE FOR STRING
1230 MOVSTR .EQ $E5E2      MOVE A STRING
1240 *--------------------------------
1250 * INSTALL & VECTOR AT $3F5
1260 *--------------------------------
1270 BEGIN  LDY #$02       MOVE 3-BYTE INSTRUCTION
1280 .1     LDA IMAGE,Y      INTO AMPERSAND VECTOR
1290        STA AMPERV,Y     AT $3F5
1300        DEY
1310        BPL .1
1320        RTS
1330 IMAGE  JMP ENTRY      IMAGE OF & VECTOR
1340 *--------------------------------
1350 * & NOW JUMPS HERE
1360 *--------------------------------
1370 ENTRY  CMP #$84       'INPUT' TOKEN?
1380        BEQ INPUT      YES
1390        LDX #$10       ERROR CODE,
1400        JMP ERROR      SYNTAX ERROR
1410 INPUT  JSR CHRGET     GET CHAR AFTER 'INPUT'
1420        CMP #$22       ASCII QUOTE?
```

How It Works

Look at the machine language source listing (this is for reference purposes only; it's easier to enter the program from the hex dump). When Applesoft sees an ampersand, it JMPs to address $3F5. This address may contain another JMP instruction to the actual machine language program. Lines 1270–1330 set up a JMP at $3F5 to the start of the program, which is labeled ENTRY. These lines provide the code that is executed when AMPER-INPUT is initialized.

After the JMP to ENTRY, the Applesoft TXTPTR (at $B8 and $B9) points to the byte that follows the ampersand in memory, and the A register is loaded with the contents of that byte. Lines 1370–1400 check to make sure this byte contains the INPUT token.

Lines 1410–1490 print the string that follows &INPUT, or a question mark if there is no string. The STRTXT subroutine sets up the string so that STRPRT can print it; between the calls to these routines the program does a syntax check to make sure a semicolon follows the string.

Lines 1500–1540 look at the variable name in the &INPUT statement, find the variable's place in the BASIC program's variable table, and branch according to variable type. On exit from PTRGET the A and Y registers contain the address in the variable table, and VALTYP ($11) contains $FF to indicate a string variable, or $00 to indicate a numeric variable. It is important to save the address in FORPNT, because the LET1 subroutine looks for it there.

Numeric Variables

Lines 1580–1850 get the user's numeric expression, evaluate it, and store the value in the BASIC program's variable table. First, TXTPTR must be saved (lines 1580–1610) because it

```
1430        BEQ .1         YES, PRINT PROMPT
1440        JSR OUTQST     USE ? FOR PROMPT
1450        JMP SEEVAR
1460 .1     JSR STRTXT     PREPARE STRING
1470        LDA #$3B       ASCII ';' ?
1480        JSR SYNCHR     ERROR IF NOT
1490        JSR STRPRT     PRINT THE STRING
1500 SEEVAR JSR PTRGET     GET POINTER INTO VAR TABLE
1510        STA FORPNT       AND SAVE IT
1520        STY FORPNT+1
1530        BIT VALTYP     STRING VARIABLE?
1540        BVS STRING     YES
1550 *-------------------------------
1560 * INPUT A NUMERIC EXPRESSION
1570 *-------------------------------
1580        LDA TXTPTR     SAVE TXTPTR
1590        LDY TXTPTR+1
1600        STA TMPPTR
1610        STY TMPPTR+1
1620        JSR INLIN      GET A LINE FROM KEYBOARD
1630        LDA BUF        NULL INPUT?
1640        BNE .1         NO
1650        LDA #$30       ASCII '0'
1660        STA BUF        (SIMULATE INPUT OF 0)
1670        LDA #$00       END OF LINE
1680        STA BUF+1
1690        BEQ .3         ALWAYS.  NO NEED TO TOKENIZE
1700 .1     CMP #$03       CTRL-C?
1710        BNE .2         NO
1720        JMP BREAK
1730 .2     LDA #$00
1740        STA TXTPTR     TOKEN REQUIRES THIS
1750        JSR TOKEN      TOKENIZE INPUT LINE
1760 .3     LDA #BUF       POINT TXTPTR AT BUFFER
1770        STA TXTPTR       SO LET1 KNOWS WHERE
1780        LDA /BUF         THE EXPRESSION IS
1790        STA TXTPTR+1
1800        JSR LET1       EVALUATE THE EXPRESSION
1810        LDA TMPPTR     RESTORE TXTPTR
1820        LDY TMPPTR+1
1830        STA TXTPTR
1840        STY TXTPTR+1
1850        RTS
1860 *-------------------------------
1870 * INPUT A STRING FROM KEYBOARD
1880 *-------------------------------
1890 STRING JSR INLIN      GET A LINE FROM KEYBOARD
1900        LDA BUF        CHECK FOR CTRL-C
1910        CMP #$03
1920        BNE .1         NO
1930        JMP BREAK
1940 .1     INX            GET LENGTH OF STRING
1950        LDA BUF,X
1960        BNE .1
1970        STX LENGTH       AND SAVE IT
1980        TXA            TELL GETSPA THE LENGTH
1990        JSR GETSPA     GET SPACE FOR STRING
2000        LDY #$00       PUT DESCRIPTOR IN VAR TABLE
2010        STA (VARPNT),Y  LENGTH FIRST
2020        INY
2030        LDA FRESPC     ADDR OF STRING, LO BYTE
2040        STA (VARPNT),Y
2050        INY
2060        LDA FRESPC+1   ADDR OF STRING, HI BYTE
2070        STA (VARPNT),Y
2080        LDX #BUF        COPY STRING INTO ITS
2090        LDA LENGTH        SPACE IN HIGH MEMORY
2100        JMP MOVSTR        (Y-REG HAS /BUF)
2110 *-------------------------------
2120 * SAVE AREA
2130 *-------------------------------
2140 LENGTH .HS 00          LENGTH OF STRING
2150 TMPPTR .HS 0000        TXTPTR
```

will be modified. The Applesoft INLIN routine is used to get the user's expression as a string. This routine puts the input into the keyboard buffer, resets the high-order bit of each byte to zero, puts a zero at the end of the string, and loads the registers—A with $00, Y with $01, and X with $FF.

Lines 1630–1690 check for null input. If null input, an ASCII zero is put into the buffer to simulate the input of a zero. Lines 1700–1720 check for CTRL-C, jumping to the BREAK routine if a CTRL-C was entered as the first character.

Lines 1730–1750 tokenize the contents of the buffer by replacing keywords with one-byte values. Lines 1760–1800 evaluate the expression. The evaluation is performed simply by pointing TXTPTR to the buffer and calling LET1. The LET1 routine not only evaluates expressions, but it stores the value in the BASIC program's variable table. It gets the address into the variable table from FORPNT (remember lines 1510–1520). LET1 can distinguish between floating point variables and integer variables because PTRGET puts $80 in address $12 to indicate an integer variable, and $00 otherwise (remember, $11 contains a $00 to indicate a numeric variable). Lines 1810–1850 restore TXTPTR and return to the BASIC program.

String Variables

Lines 1890–2100 get the user's string into the keyboard buffer, store it and its descriptor, and return to the BASIC program. Again, INLIN is used to get the string into the buffer. The program checks for CTRL-C and jumps to the BREAK routine if CTRL-C was entered as the first character of the string (lines 1900–1930). The program then finds the length of the string and puts it in the A register. The length is also stored locally.

The program calls GETSPA to find an address in high memory where the string can be stored; on entry to GETSPA the A register must contain the length, and on exit the address is in FRESPC. After the call to PTRGET (line 1500) the address of the string's descriptor (in the BASIC program's variable table) could be found in VARPNT. Lines 2000–2070 now use VARPNT to move the string descriptor into the variable table.

Finally, lines 2080–2100 call the MOVSTR routine to move the string itself into its spot in high memory. To call MOVSTR, the A register must contain the string's length, and the X and Y registers must contain its present address. The destination is the address in FRESPC. Note that the Y register was not explicitly loaded because it incidentally contains the proper byte, which is the high-order byte of the address of the keyboard buffer (see lines 2000, 2020, and 2050). ©

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INSIGHT: Atari

Bill Wilkinson

I have almost worked my way through my backlog of letters, so I will once again appeal to all of you to keep those cards and letters coming. Since it can sometimes take quite a while for a letter sent to COMPUTE!'s editorial offices to wend its way to me, I have decided to give you an address where you can write me directly:

Bill Wilkinson
c/o OSS
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San Jose, CA 95171-0352

Before I start answering questions this month, I would like to talk a little about the future of Atari.

Right From The Source

I had the rare privilege to attend the meeting of the San Leandro (California) Atari User Group on the evening that Leonard Tramiel agreed to come and answer questions.

I hope the name Tramiel is familiar to all Atari owners by now. Jack Tramiel, the founder and former leader of Commodore, bought Atari from Warner Communications in July. Leonard, Jack's son, is now head of software at Atari. And though I am sure some favoritism was involved in choosing him for the position, I think it was probably an excellent appointment.

Leonard Tramiel is an articulate, humorous, open, and opinionated person. He endeared himself to me when he espoused one of my favorite opinions: The IBM PC is an eight-bit machine, and the Apple Macintosh is a 16-bit machine, and no amount of marketing ballyhoo is going to change that. (We are referring to the fact that the width of the data path to the Central Processing Unit (CPU) controls processing speed as much as, if not more than, the speed of register operations. Whew! Got that? There will be a quiz on Monday.)

Anyway, while Leonard was extremely careful to avoid divulging any technical details about future Atari computers, he went a long way toward reassuring many listeners (for example, me) that Atari in general (and Leonard Tramiel in particular) knows what it is doing and where it is going. By the time you read this, the Winter Consumer Electronics Show (CES) in Las Vegas will be underway. And we're expecting to see the introduction of 16-bit and 32-bit Atari computers.

However, I also came away with the feeling that Atari will not abandon the eight-bit, 6502-based market for some time to come. In particular, Leonard stated emphatically several times that the 800XL would undergo only those modifications which would make it "both less expensive and more reliable."

Preserving Atari Loyalty

Possibly Leonard missed his calling: As a public relations person he did an outstanding job. I didn't take a formal poll, but I believe the impression he left on the audience was in the range of 90 to 95 percent positive. If there were any real negatives, it was regarding his stand that he wouldn't guarantee that current Atari peripherals would work on the new machines.

The attitude of some in the audience was, "Well, if I can't use my peripherals on the new machines, I am going to look at all computers instead of just Atari's." That's a reasonable attitude, but the response was just as rational: "If Atari can't convince you to buy the new machines on their merits and prices alone, then we don't know what we are doing." And finally, my view is that—with the possible exception of printers—there are very, very few Atari peripherals that I would want on a new, super-duper computer. (Who wants to talk to a disk drive at 19200 baud? Who really likes the kludge that became the 850?)

In summary, then, I have a better feeling about the future of Atari than I have had in a year or more now: to the point that our company, OSS, is continuing with plans for more and new Atari-compatible products. I will withhold judgment of the new machines until I see their software (*Please* give us an operating system! Not CP/M, MS-DOS, or Apple or Commodore style!), but with Leonard Tramiel's leadership I have some hopes in that direction, also.

Where It's At

I've received a few letters in recent weeks asking if there is a good list of important memory locations for Atari computers. Oh, come now, COMPUTE!. Can it be that you are not advertising your 1983 book *Mapping the Atari*? To my knowledge, this is the one and only complete memory map of Atari computers. Further, it is much more than a memory map. It gives example programs, discusses which system routines will use and/or change certain locations, and much, much more. And yet there are readers of this magazine who are not aware of this book! How can that be?

Well, to be fair, the cover of *Mapping the Atari* does state that it is intended for owners of Atari 400 and 800 models. However, the people who wrote me own either 1200XLs or 800XLs. Does that matter? Not really.

More than 99 percent of the significant memory locations are the same in *all* Atari computers: 400, 800, 1200XL, 600XL, 800XL. Notice that I did qualify that just a little. Just what is a *significant* memory location?

Sidetrack: If you have been reading this column for any time at all, you know that I feel that the compatibility problems which many software vendors suffered when the XL machines appeared are the *fault of the vendors*. Since the first documentation from Atari appeared in the marketplace, Atari made a point of specifying which memory locations would control what functions, which subroutine entry points (mainly vectors) would remain unchanged, and which parts of the operating system (OS) were subject to change. Surely, when Atari released its first revision of the OS in early 1982, you would think the vendors and authors would have been put on notice: "Hey, guys, things are subject to change, and this proves it." The reply: "Yeah, but if I know that this routine at $D099 will save me two bytes of code, I'm gonna use it."

The only consolation I seem to get is that every other machine seems to have the same kind of problem: Apple programmers had to go back to the drawing board when the IIe and IIc arrived. Many major programs for the IBM PC simply do not run on the PC-AT. Nobody can write machine language software for Commodore computers and expect it to work on more than a single model. The list goes on.

Mapping XL Memory

Back to the memory map: Generally, if you use *Mapping the Atari* with an XL machine, you can trust most of the RAM locations that are listed. Atari did publish a set of locations that were changed in the XL machines, but there were not many. Even the ones that did change were ones unlikely to be used: OLDROW and OLDCOL moved, but the only routines that use them are FILL and DRAWTO. And even if you were to call for a FILL, you probably would do so after a PLOT, which automatically sets up OLDROW and OLDCOL for you.

The ROM locations listed in the book are a bit more subject to change. As a rule of thumb, I would trust only the information about the last few bytes of a cartridge, the floating point ROMs, and $E400 through $E462. Also, it's a pretty sure bet that if the book mentions a difference between OS revision A and revision B when discussing a location, there will be yet another difference in the XL machines. (Example: Anybody who thinks that EOUTCH—output a character to the screen—is at an immutable location should refrain from using a machine manufactured after 1916.)

So all you XL machine owners should rush out and buy a copy of *Mapping the Atari*. And then you should write to COMPUTE! and tell them (don't ask) to publish an update, either in the form of a revised book or a low-cost appendix, for XL computers.

More No-Nos

As long as we are on the subject of only using *legal* memory locations (see how I sneaked that in?), let me respond to a couple of people who have asked a relevant question: "I have an 800XL, and I can't get it to put characters to the screen if I follow the instructions in *Machine Language for Beginners*. How can I change the program so it will work?"

When Richard Mansfield wrote that book, he was writing for Commodore, Apple, and Atari owners. And all the machines he was writing for *except Atari* have a documented entry point for a routine which will put a single character on the screen. So, for uniformity, he used an undocumented subroutine call on the Atari computers which does much the same thing. At the time he did this, that particular location had been written up several times in both the professional and amateur press, so he felt fairly safe. Ah, well, Richard, even the best of us have to be bitten once in a while.

The proper way to do any input/output (I/O) on an Atari computer is via Central Input/Output (CIO) calls. In early 1982, I wrote a series of articles on CIO calls which appeared in this column. I am not going to repeat that series, but I will give you a few pointers to get you started with CIO.

There are two things you can do if you want more info on the subject: (1) Find a library (perhaps a user group library) with back isues of COMPUTE! (don't write the magazine; they don't have any). (2) Get your hands on a copy of the *Atari Technical Reference Manual* (it used to be $30 from Atari customer service, but I don't know where you can get it now). The manual includes a pretty fair description of CIO along with lots and lots of other very worthwhile goodies.

The Legal Solution

Without further ado, then, let's look at how to put a character on the screen.

```
0200 IOCB0 = $0340
0210 IOCBCMD = $0342
0220 IOCBLEN = $0348
0230 CMDPUT = $0B
0240 CIO =    $E456
0250 ;
0260 ;Enter with character in A
     register
0270 ;Routine will print it to screen
0280 ;
0290 PUTSCREEN
0295      LDX #CMDPUT
0300      STX IOCBCMD ; request output
0310      LDX #0      ; multi-purpose
     zero
0320      STX IOCBLEN ; first, zero
     length
0330      STX IOCBLEN+1 ; (both bytes)
0340      JMP CIO     ; and now X is
     channel for CIO
```

That's it. Simply put those six lines of code anywhere in your machine language program. Then, when you want to print a character on the screen, use JSR PUTSCREEN after placing the character in the A register.

In theory, you can get an error when you call CIO (a minus value in the Y register indicates this), but in practice I don't believe you will ever see one as a result of putting a character to the screen.

How, you may ask, is this any better than calling a point in the OS ROM which does the same thing? Answers: (1) This way works on all Atari computers (well . . . the 6502-based ones, at least). (2) This follows Atari's rules. If you do it this way, Atari could scramble the OS ROMs anyway they wanted, but your program would still run.

Of course, the equates at the beginning of the program fragment are the keys to the whole thing. IOCB stands for *Input/Output Control Block*. Technically, you are supposed to put the channel number times 16 in the X register and then access the appropriate IOCB via X (see below). Since the screen is always open on channel zero, I took a legitimate shortcut. Similarly, CIO is actually a vector in the OS ROMs which is guaranteed to stay in place. If you follow the rule about using the X register to access the IOCBs, you are already set up for CIO, which *requires* the channel number times 16 in the X register.

Oh, yes. Normally, CIO expects to transfer an entire buffer (for example, a line of text), in which case you must give CIO the buffer address and its length. But CIO cleverly provides for situations in which you want to print only a single character: Tell CIO that the length of the buffer is zero, and it will output a single character (or input a character, but that's a topic for another time) via the A register.

And that's about it. Simple, really. Before we quit for this month, though, I would like to show you how simply that routine could be converted to output a character to *any* channel.

```
0200 IOCB0 = $0340
0210 IOCBCMD = $0342
0220 IOCBLEN = $0348
0230 CMDPUT = $0B
0240 CIO =    $E456
0250 ;
0260 ;Enter PUTC with the character
0270 ;    in the A register and the
0275 ;    channel number times 16 in
     the
0280 ;     X register.
0285 ;
0290 PUTC
0300      PHA         ; save character
     for a moment
0310      LDA #CMDPUT ; request output
     ...
0320      STA IOCBCMD,X ; ... on this
     channel
0330      LDA #0
0340      STX IOCBLEN ; now, zero
     length
0350      STX IOCBLEN+1 ; (both bytes)
0360      PLA         ; recover the
     character
0370      JMP CIO     ; and now X is
     channel for CIO
```

Do you see the really minimal changes we made? This is one of the beauties of the Atari OS. It is so completely organized (*orthogonal* is a good computerese word for it) that it's actually easy to learn and use. Perhaps we'll do a little more of this if you would like. Write and tell me. ©

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IBM Personal Computing

Donald B. Trivette

Music For Amateurs

The theme of this month's COMPUTE! is music, so the editor suggested I write something about making music with the IBM PC and PCjr. Great idea, except I know less about music than Beethoven knew about BASIC. I did write a musical game called "Name These Notes." It's similar to the *Name That Tune* TV show. The first player who stops the music and identifies the correct tune gets the points. But before I could even test the program, I had to hire a music student to translate sheet music into computer music. Although the game is lots of fun, no software publisher will touch it—something about paying royalties on all those tunes, but that's another story. The point is that you don't have to know anything about scales or octaves or half notes to experiment with music on your IBM—or even to write a musical game.

Both the PC and the PCjr have the circuits necessary to generate tones, both have a tiny internal speaker for playing those tones, and both run a version of the BASIC programming language which includes a music-making command. Start up your PC or PCjr and try it.

The PLAY Statement

First you must get the proper version of BASIC running on your computer. Although the PC and PCjr have a built-in BASIC—a version of the language that is a permanent part of memory—*that* BASIC does not have the command that allows you to play music. Instead, you'll need the advanced disk version of BASIC on the PC (also known as BASICA), or Cartridge BASIC on the PCjr. BASICA for the PC is included on the DOS disk; Cartridge BASIC for Junior is an extra-cost option.

For the PC: First load DOS, then type BASICA at the A> prompt. For the Entry Model PCjr: Insert Cartridge BASIC in either front slot and switch on the computer. For the Enhanced Model PCjr: Insert Cartridge BASIC, load DOS, and type BASIC at the A> prompt.

Once the BASIC prompt Ok is displayed on the screen, you are ready to compose. We'll start with something simple. The BASIC music statement is named PLAY. Type **PLAY "CDE"** and press the Enter key. You'll hear the musical notes C, D, and E played by your computer. (If you typed the statement correctly but got a Syntax Error anyway, then you're running the wrong version of BASIC.) When typing notes, upper- and lowercase characters and spaces are unimportant; "CDE" sounds just like "c d e". Should you be musically inclined, you'll recognize these notes as *do, re, mi*—the first three notes of the diatonic scale. Now type **PLAY "CDEFGAB"** and press the Enter key again. Those are the seven basic notes of the scale from which all music is composed on the computer (or any other musical instrument, for that matter).

There are lots of things that can be done with those seven notes. For example, if they are played in a low octave, they will sound, well, low; and if they're played in a high octave, they'll sound high. (That is the sum total of my knowledge regarding octaves.) The PC and PCjr can reproduce seven octaves. The PLAY statement defaults to octave 4, but gives you a way to change the octave. It's the O character (for Octave)—the fifteenth letter of the alphabet. The PCjr BASIC manual doesn't distinguish between the numeric 0 and the alphabetic O. This is sure to cause readers great frustration when they try running the examples in the book. The PC BASIC manual, on the other hand, is printed with slashed zeros to represent the numeric 0. To simplify, I'll use a lowercase o for the alphabetic character.

Changing Octaves Within Tunes

Now let's mix in a few octave changes to hear the effect. Try entering these lines:

```
PLAY "o0 CDEFGAB"
PLAY "o6 CDEFGAB"
PLAY "o2 CD o4 EF o6 AB"
```

Look up the PLAY statement in your BASIC manual to see all the things that can be done with the notes. They may be played sharp or flat (+ or −); for different lengths of time (L*n*, where *n* = 1 for a whole note, 2 for a half note, 4 for a quarter note, etc.); in different tempos (T*n*, where *n* = 32 to 255 quarter notes per minute); and in legato (ML), staccato (MS), or normal (MN). It's not necessary to know what these terms mean to have fun playing music. In fact, experimenting with these options is a good way to learn what they *do* mean. Try this:

```
PLAY "ms o3 CDEFGAB"
PLAY "ml o3 CDEFGAB"
PLAY "t50 ms o3 CDEFGAB"
PLAY "t250 ml o3 CDEFGAB"
```

Even the tone deaf will notice that music from the PC doesn't sound quite right. It sounds tinny and mechanical. Part of the problem is the small internal speaker—IBM is a computer company, not a music company—and part of the problem is that the PC has only one *voice*, or sound channel. In other words, it's *monophonic*: It can play only one note at a time, so it can't make chords or blend notes together.

Junior's Improved Sound

The PCjr is more musically accomplished than its big brother. It has an external speaker jack (marked A for Audio on the rear panel) which can be connected directly to your stereo system. By running an inexpensive cable (available from any audio store) to your amplifier, Junior can make beautiful music through your high-fidelity speakers. (For a simple way to modify your PC to hook it up to a stereo system, see "The Amplified PC," COMPUTE!'s PC & PCjr magazine, September 1984.)

Plus, there's an even more important difference between the PC and PCjr's sound capabilities. The PCjr has an extra *polyphonic* sound chip that allows it to play up to three voices at once. In fact, it's the same sound chip found in the discontinued Texas Instruments TI-99/4A home computer. The other members of the PC family do not have this chip and are restricted to monophonic music.

Junior's extra voices only work when the computer is connected to an external speaker system, a TV set, or to IBM's RGBjr Display, which has a speaker of its own. Otherwise, Junior's internal speaker works just like the PC's internal speaker—it supports but one voice.

If you have your PCjr connected to an external sound system, try this three-voice composition:

```
10 SOUND ON
20 PLAY "mn CDEFGAB","ml CDEFGAB","ms
CDEFGAB"
```

It's not music to my ears either, but it does demonstrate what three scales, played at the same time, sound like. For a more melodious example, run the multiple-voice program from the PCjr BASIC manual on page 4-272. (My manual has some typographical ambiguities: In line 50, the three O's should be the alphabetic characters; in line 150, "1=1;" really means "L=L;".) Notice that to turn on Junior's external speaker and use more than one voice, you must first include the SOUND ON statement. There is no equivalent for that on the PC.

A PC/PCjr Music Utility

Enough about multiple voices. You've got to know what you are doing, musically, to program them in a pleasant way. To satisfy both groups of readers, the tunes in this column are in one voice only; they play on either the PC or the PCjr.

When I was working on "Name These Notes," I needed a utility program to display the notes on the screen as they were played. This helped the musician, who was reading the chicken scratches on sheet music, to catch typographical errors on the screen. Things begin to get fuzzy when you've been staring at a screenful of "DDDP16DDG8A8B8DDDP" for an hour.

The program listing following this column is a modified version of that utility—a program that displays as it plays. It has two modes: a slow mode, in which the display may cause the music to be played more slowly (especially the "William Tell Overture"); and a fast mode that has no delay. I've put in a few tunes for which there are no royalty fees (I hope). If you can read sheet music, add a few tunes of your own. If you can't, try changing the tempo and octaves on these. The results can be fun. (If you have a PCjr, be sure DOS *and* Cartridge BASIC are running so you can save the program on disk.)

For the lazy but curious: If you just want to hear the tunes, you need only type the word PLAY and the character string of notes. For example, to hear "America," type PLAY "GGAF+4.G8ABBo4 . . . ."

The first five lines, 10–50, are the character strings that make up the tunes; lines 60–80 are for your own compositions. For instance, to add the scales as tune number 6, type:

```
60 X$(6)="Scales=CDEFGAB"
```

Notice that the title is separated from the notes by an equal sign. While BASIC doesn't care whether you put blank spaces between the musical notes, this program does. Should you type the scale as "CDE FGAB", only the first three notes will be displayed and played. The musical notes (A–G) must be in uppercase; the other characters may be upper- or lowercase. I used lowercase, except for the L (length), which might be easily confused with a 1.

BASIC limits the length of a character string—the stuff between the quote marks—to 255 characters. There is a way to play longer pieces using what the BASIC manual describes as an "X variable."

PLAY "T120 L12o2CFAL6o3CL12o2AL4o3C"

New Software

Now for some personal notes on software. There are two new programs for the PCjr that deserve mention this month. *Managing Your Money* (written by MECA and distributed by IBM) is now available on cartridge for $199. This is the same great program that runs on the PC; it will take care of all your home accounting, budgeting, investing, and tax problems. This may be the program that does for PCjr sales what *VisiCalc* did for the Apple.

IBM is also the distributor for *King's Quest* by Sierra, a new fantasy game ($50). If you want to see how good graphics can be on the PCjr, try this one. The animated characters, lifelike images, challenging puzzles, and tricky strategy make *King's Quest* a winner. (The version sold under the IBM logo will only run on the PCjr. However, Sierra markets identical versions for the Apple, Tandy, and IBM PC computers.) Looking for a last-minute Christmas gift for a PCjr owner? This is it. (Should any of you figure out the gnome's name, please write me.)

PC/PCjr Music Display Utility

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
HM 10 X$(1)="America=GGAF+4.G8ABBo4Co3
      B4.A8GAGF+G2.o4DDDD4.C8o3Bo4CCCC
      4.o3B8ABo4mlC8o3B8A8mnG8B4.o4C8D
      mlE8mnC8o3BAG2."
IF 20 X$(2)="America the Beautiful=GG4
      .E8EGG4.D8DEFGABG2.GG4.E8EGG4.D8
      Do4DC+DEo3Ao4D2.o3Go4E4.E8DCC4.o
      3B8Bo4CDo3BAGo4C2."
GF 30 X$(3)="Silent Night=T65mlF8.mnG1
      6F8D4.mlF8.mnG16F8D4.o4CC8o3A4.B
      -B-8F4.GG8mlB-8.mnA16G8mlF8.mnG1
      6F8D4."
GD 40 X$(4)="William Tell Overture=L16
      o3DDDp16DDDp16DDG8A8B8DDDp16DDDp
      16BBA8G-8D8DDp16DDDp16DDG8A8B8p1
      6Go4D4p8o3G8B8G8"
IB 50 X$(5)="Mary Had a Little Lamb=t1
      00o3L8GFE-FGGGp8FFF4GB-B-4GFE-FG
      GGGFFGFE-0."
HM 60 X$(6)="="
HE 70 X$(7)="="
IM 80 X$(8)="="
PE 90 X$(9)="End Program="
LK 100 KEY OFF
KG 110 CLS:PRINT "Tunes"
LP 120 FOR I=1 TO 9
HP 130 PRINT I;MID$(X$(I),1,INSTR(X$(I
       ),"=")-1)
NF 140 NEXT
PL 150 PRINT:PRINT "Enter tune number:
       ";
EA 160 A$=INKEY$:IF A$="" THEN 160
MI 170 I=VAL(A$)
LJ 180 IF I=0 THEN GOTO 110
MI 190 IF I=9 THEN END
BC 200 B$=X$(I)
ID 210 PRINT
QJ 220 REM
LE 230 PRINT "Enter: F for fast or S f
       or slow: ";
CO 240 A$=INKEY$:IF A$="" THEN 240
HL 250 IF A$="F" OR A$="f" THEN GOTO 4
       60
JN 260 PRINT
DK 270 '-- Begin Slow Mode --
GJ 280 TIT$=MID$(B$,1,INSTR(B$,"=")-1)
       :PRINT TIT$
JM 290 PLAY "T120O3MFMNL4"
MC 300 C$=MID$(B$,INSTR(B$,"=")+1)+" "
EB 310 C$=MID$(C$,1,INSTR(C$," ")-1)
IC 320 KK=LEN(C$):KIK=0:T$=""
KB 330 FOR KI=1 TO KK
OL 340 IF KI MOD 25 =0 THEN PRINT
GL 350 W$=MID$(C$,KI,1)
BH 360 IF W$<"A" OR W$>"G" THEN GOTO 3
       90
PD 370 COLOR 15:PRINT T$;" ";:PLAY T$:
       COLOR 7:LOCATE ,POS(0)-(LEN(T$)
       +1):PRINT T$;" ";
CM 380 T$=""
OL 390 T$=T$+W$
AB 400 NEXT KI
PI 410 COLOR 15:PRINT T$;" ";:PLAY T$:
       COLOR 7:LOCATE ,POS(0)-(LEN(T$)
       +1):PRINT T$;" ";
QI 420 PRINT:PRINT
OL 430 PRINT:PRINT "Press any key to c
       ontinue.";
GK 440 A$=INKEY$:IF A$="" THEN 440
BE 450 GOTO 110
DP 460 '-- End Slow Mode -- Begin Fast
        Mode --
CN 470 PRINT:PRINT:PRINT
GL 480 TIT$=MID$(B$,1,INSTR(B$,"=")-1)
       :PRINT TIT$
IM 490 PLAY "T120O3MFMNL4"+MID$(B$,INS
       TR(B$,"=")+1)
BL 500 GOTO 110
```

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C Regena

Mixing Graphics And Music

I've talked about combining graphics with music in a TI program before. This month I'll add a few more ideas and techniques to try to help you in your programming. Remember, there are many ways to do the same thing, and the important idea is to enjoy your computer!

Clear-Screen Effects

The command CALL CLEAR is the usual way to quickly clear the screen. For a different effect, try:

```
CALL HCHAR(1,1,32,768)
```

or

```
CALL VCHAR(1,1,32,768)
```

These statements tell the computer to start with the first row and first column and fill the screen with 768 spaces (ASCII character 32).

If you want to fill the screen with a color, try the following example. Set the variable C to the desired color number:

```
100 CALL CLEAR
110 CALL SCREEN(C)
```

or

```
100 CALL COLOR(9,C,C)
110 CALL HCHAR(1,1,96,768)
```

Following is a sample program segment that illustrates another way to clear the screen—by starting at the center and moving outward.

```
100 CALL CLEAR
110 CALL COLOR(9,14,14)
120 C=13
130 T=8
140 U=0
150 FOR R=12 TO 1 STEP -1
160 CALL HCHAR(R,C,96,T)
170 CALL VCHAR(R+1,C,96,U)
180 CALL VCHAR(R+1,C+T-1,96,U)
190 CALL HCHAR(R+1+U,C,96,T)
200 C=C-1
210 T=T+2
220 U=U+2
230 NEXT R
240 GOTO 240
```

Another effect is to change all the spaces to a different color by redefining the color for color set 1:

```
CALL COLOR(1,2,7)
```

This definition will retain the default foreground color of black (color 2) for the symbols in set 1, but will change the background color to 7. Since the space character is blank, the background color shines through wherever there's a space.

Making The Invisible Visible

The CALL COLOR statement changes the color of any characters in the specified set on the screen. For example, try writing a program to print a message on the screen, then follow the message with this statement:

```
200 CALL COLOR(5,10,1)
```

All the characters in set 5 will change from black to red.

Remember that the number 1 in a color definition means transparency, or the current screen color. Try drawing something on the screen transparently, then use a different CALL COLOR statement to make the object appear all at once. For example:

```
100 CALL CLEAR
110 CALL COLOR(6,1,1)
120 PRINT "HI JIM":::
130 CALL COLOR(6,13,1)
140 GOTO 140
```

Line 100 clears the screen, then line 110 defines the colors for set 6 to be transparent. Line

120 prints a message and scrolls it upward. Line 130 makes the printing visible by changing the color set to dark green. Line 140 keeps the color on the screen until you press CLEAR.

Changing Character Shapes

Another technique you may have fun with is to change a character definition while the character is on the screen. For example, suppose you have a lot of printing on the screen, then you use CALL CHAR to redefine the letter E as a straight line. Wherever there is an E on the screen, it will suddenly appear as a straight line. The following sample program illustrates what happens when you change the definition of the space character. The GOSUB statement is a simple delay loop to pause between definitions.

```
100 CALL CHAR(32,"FF")
110 GOSUB 190
120 CALL CHAR(32,"0102040810204
    08")
130 GOSUB 190
140 CALL CHAR(32,"1010101010101
    01")
150 GOSUB 190
160 CALL CHAR(32,"8040201008040
    201")
170 GOSUB 190
180 GOTO 100
190 FOR D=1 TO 200
200 NEXT D
210 RETURN
220 END
```

Graphics can be a lot of fun. If you like to use graphics, you really need to just sit at the computer and try different things. See what happens if you define the colors first, then display the characters, or if you change the colors after the graphics are on the screen. Try defining the characters before or after printing them on the screen. Look at the difference between using PRINT and CALL HCHAR or CALL VCHAR statements.

A Holiday Greeting

This month I've included a program which is my holiday greeting to you. This program combines sound and graphics using some of the techniques previously discussed. Here's a breakdown of the program.

Line 100 clears the screen, then line 110 changes the screen color to dark blue. The default values of a CALL COLOR statement are black printing on a transparent (screen color) background. Line 140 will change all the spaces to a blue background rather than screen color. The CALL COLOR statements in lines 150–190 change the color sets for graphics to be solid blue squares—the graphics will be drawn invisibly at first. The CALL COLOR statements in lines 200–240 change the printing to white letters on a blue background.

Lines 320–440 print the graphics on the screen. These lowercase letters and symbols need to be typed with the ALPHA LOCK key released. Turn the ALPHA LOCK key back on to type the rest of the program. Since the letters are blue with a blue background on a blue screen, you won't see anything yet.

Line 480 changes the screen color to black. In effect, this puts a black border around the screen (recall that all spaces and other characters are blue). The extra PRINT statements and colons format an attractive left and right margin.

Lines 490–860 define the graphics characters while music is set up and playing. Remember, the graphics are already on the screen, but are invisible because they are blue. Lines 870–890 change the colors of sets 10, 11, and 12 to red with a blue background, making the sleigh appear. Line 920 changes the colors of set 9 so all the reindeer appear instantly.

If you'd like the message to blink, you can add some CALL COLOR statements for sets 5 through 8 among the CALL SOUND statements in lines 930–1170.

Adding The Sound Track

After the graphics in this program were completed, I added the SOUND statements for the music. Line 120 sets a tempo or time of 440. By using the variable T at the beginning of the program and expressing all durations as a function of T, you can change the tempo of the whole song by simply adjusting the value of T in line 120.

When writing the program, I tried only the melody notes of the song first to make sure the graphics did not interfere with the tempo of the music. Later I added two accompaniment notes for each statement.

Sometimes when you have two CALL SOUND statements with the same note and volume, the resulting sound is one long note rather than two shorter notes. To make sure you get distinct notes, you can change the volume numbers slightly. If you want to make two different chords sound like they have a common tied note, keep the frequency and volume the same for that note.

To make the melody heard over the accompaniment, use a louder volume for the melody notes. For example, use a volume of 2 for the melody, 5 for the middle note, and 8 for the bottom note:

CALL SOUND(T,466,2,294,5,175,8)

If you don't want to type this program, you can get a copy by sending a blank cassette or disk, a stamped, self-addressed mailer, and $3 to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

Please specify the title of the program ("Jolly Old St. Nick") and that you need the TI version. Hope you have fun making your own holiday greeting programs!

Jolly Old St. Nick

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 CALL CLEAR
110 CALL SCREEN(5)
120 T=440
130 CALL SOUND(T,587,2,466,5,17
    5,8)
140 CALL COLOR(1,16,5)
150 CALL COLOR(9,5,5)
160 CALL COLOR(10,5,5)
170 CALL SOUND(T,587,3,466,6,17
    5,8)
180 CALL COLOR(11,5,5)
190 CALL COLOR(12,5,5)
200 CALL COLOR(5,16,5)
210 CALL SOUND(T,587,2,466,5,17
    5,10)
220 CALL COLOR(6,16,5)
230 CALL COLOR(7,16,5)
240 CALL COLOR(8,16,5)
250 CALL SOUND(T,587,3,466,7,17
    5,10)
260 PRINT
270 CALL SOUND(T,523,2,440,5,15
    6,8)
280 PRINT
290 CALL SOUND(T,523,3,440,6,15
    6,8)
300 PRINT
310 CALL SOUND(T*2,523,2,440,5,
    156,8)
320 PRINT :"  `a"
330 PRINT " bcd{3 SPACES}`a"
340 CALL SOUND(T,466,2,392,5,14
    7,8)
350 PRINT "{3 SPACES}ef bcd
    {3 SPACES}`a"
360 CALL SOUND(T,466,3,392,7,14
    7,8)
370 PRINT TAB(9);"ef bcd
    {3 SPACES}`a"
380 CALL SOUND(T,466,2,392,5,14
    7,10)
390 PRINT TAB(14);"ef bcd
    {3 SPACES}hijkl"
400 CALL SOUND(T,466,3,294,5,19
    6,10)
410 PRINT TAB(19);"ef  mnopq"
420 CALL SOUND(4*T,587,2,349,5,
    147,8)
430 PRINT TAB(23);"rstuv"
440 PRINT TAB(23);"wxyz{"
450 PRINT :::TAB(7);"MERRY CHRI
    STMAS"
460 PRINT ::TAB(13);"FROM"
470 PRINT ::TAB(12);"REGENA":::
480 CALL SCREEN(2)
490 CALL CHAR(96,"061F1F071F3E7
    CFC")
500 CALL CHAR(97,"30F6FF8FF8")
510 CALL CHAR(98,"0001070F3F303
    81")
520 CALL CHAR(99,"FEFFFFFFFF3F"
    )
530 CALL SOUND(T,392,2,311,5,11
    7,8)
540 CALL CHAR(100,"01FFFFFEFEFE
    7E3F")
550 CALL CHAR(101,"0F01")
560 CALL SOUND(T,392,3,311,7,11
    7,10)
570 CALL CHAR(102,"C0C0E0701808
    ")
580 CALL CHAR(104,"000000000000
    0003")
590 CALL SOUND(T,392,2,311,5,11
    7,8)
600 CALL CHAR(105,"000000000000
    00C")
610 CALL CHAR(106,"0000010086C1
    E8CE")
620 CALL SOUND(T,392,3,311,7,11
    7,10)
630 CALL CHAR(107,"000CCEE77737
    909")
640 CALL CHAR(108,"00000008D8F0
    003")
650 CALL SOUND(T,349,2,294,5,11
    7,8)
660 CALL CHAR(109,"0F0F0F0F0600
    001C")
670 CALL CHAR(110,"F0FC7D3D3C7C
    FEFF")
680 CALL SOUND(T,349,3,294,7,11
    7,10)
690 CALL CHAR(111,"6F67E3F0FF7F
    1E")
700 CALL CHAR(112,"03C7870FECC0
    030F")
710 CALL SOUND(2*T,466,2,294,5,
    117,8)
720 CALL CHAR(113,"FCFEF0801F7F
    FEE")
730 CALL CHAR(114,"70C0C0C0C060
    781E")
740 CALL CHAR(115,"7F3F1F03703F
    1C38")
750 CALL CHAR(116,"E0FFFFFF7F07
    001E")
760 CALL CHAR(117,"FFFFFFFFFEFC
    ")
770 CALL SOUND(T,440,2,349,5,17
    5,8)
780 CALL CHAR(118,"C0808")
790 CALL CHAR(119,"03")
800 CALL SOUND(T,466,2,349,6,17
    5,10)
810 CALL CHAR(120,"F83E03")
820 CALL CHAR(121,"0707FF1F")
830 CALL SOUND(T,523,2,349,5,22
    0,8)
```

```
840 CALL CHAR(122,"F08080C07F")
850 CALL CHAR(123,"00C06060C")
860 CALL SOUND(T,587,2,349,7,23
    3,8)
870 CALL COLOR(10,10,5)
880 CALL COLOR(11,10,5)
890 CALL COLOR(12,10,5)
900 CALL SOUND(2*T,523,2,349,8,
    220,10)
910 CALL SOUND(2*T,523,2,440,8,
    175,10)
920 CALL COLOR(9,11,5)
930 CALL SOUND(T,587,2,466,5,17
    5,8)
940 CALL SOUND(T,587,3,466,6,23
    3,8)
950 CALL SOUND(T,587,2,466,5,17
    5,8)
960 CALL SOUND(T,587,3,466,6,23
    3,8)
970 CALL SOUND(T,523,2,440,5,17
    5,8)
980 CALL SOUND(T,523,3,440,6,31
    1,8)
990 CALL SOUND(T*2,523,2,440,5,
    175,8)
1000 CALL SOUND(T,466,2,392,5,1
     96,8)
1010 CALL SOUND(T,466,3,392,6,2
     94,8)
1020 CALL SOUND(T,466,2,392,5,1
     96,8)
1030 CALL SOUND(T,466,3,294,5,2
     33,8)
1040 CALL SOUND(2*T,587,2,349,5
     ,220,8)
1050 CALL SOUND(2*T,587,2,349,5
     ,262,8)
1060 CALL SOUND(T,392,2,311,5,1
     56,8)
1070 CALL SOUND(T,392,3,311,6,1
     33,8)
1080 CALL SOUND(T,392,2,311,5,1
     56,8)
1090 CALL SOUND(T,392,3,311,6,1
     33,8)
1100 CALL SOUND(T,349,2,294,5,1
     17,8)
1110 CALL SOUND(T,349,3,294,6,2
     33,8)
1120 CALL SOUND(2*T,466,2,294,5
     ,117,8)
1130 CALL SOUND(T,523,2,311,5,2
     20,8)
1140 CALL SOUND(T,466,2,294,5,1
     75,8)
1150 CALL SOUND(T,523,2,311,5,2
     20,8)
1160 CALL SOUND(T,587,2,349,5,1
     75,8)
1170 CALL SOUND(4*T,466,2,294,5
     ,175,8)
1180 CALL KEY(0,K,S)
1190 IF S<1 THEN 1180
1200 CALL CLEAR
1210 END
```

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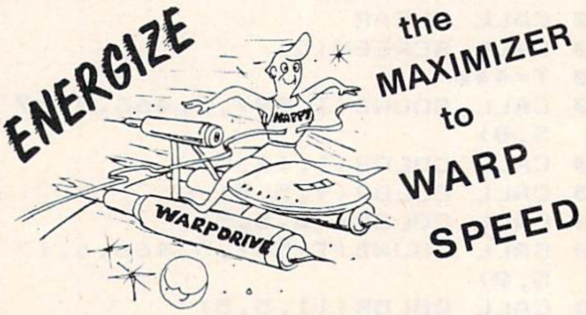

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JTERM For Atari

Frank C. Jones

This versatile terminal program lets you communicate with electronic bulletin boards, access commercial information services, link up to mainframe computers at your school or business, and to upload and download files over the phone lines. Version 3.2 was first published in COMPUTE! *in January 1983. The improved version 3.8 listed here adds support for 1200 bps modems and several other features. The program is written in BASIC and machine language, and requires at least 32K RAM plus a modem attached to an 850 Interface Module or its equivalent.*

"JTERM" is a flexible and responsive terminal program developed over several months with feedback from many people. It was born primarily because I was too cheap to go out and buy a commercial product. I wanted to try out my new communications hardware and look into some of the electronic bulletin boards (BBSs) I had heard about. Furthermore, I used a mainframe computer at work and thought it would be convenient to access it from the privacy of my home.

My first attempt was to copy a short BASIC program by Henrique Veludo in COMPUTE! ("Atari As Terminal," February 1981). The program worked, but I started making enhancements here and there, including a machine language routine to speed things up a bit. Before long I added the upload/download capability so I could transfer programs and text files to friends who had computers and modems.

About this time I joined an Atari user group in Washington, D.C., and discovered its BBS, run by sysop (system operator) Frank Huband. Soon I learned that some members did not have terminal programs that would do some things that mine would. I offered to donate my program to the club and uploaded it to the BBS. That's when the fun started.

I got calls with problems. I got calls with complaints. I got calls with suggestions. Huband picked up a few suggestions and complaints too. We started working together to incorporate as many of the reasonable ideas as we could, and during the next few months the program grew. As a result, JTERM is a thoroughly tested and debugged terminal program. Over the past few years it's been used successfully for thousands of hours by thousands of people.

Starting Up JTERM

First—and this is important—*save the program on disk or tape before running it for the first time.* To conserve memory, JTERM erases part of itself after initializing. If you run it before saving a copy, most of your typing will go down the drain.

When you're ready to get started, insert the BASIC cartridge (of course, the Atari 600XL and 800XL have built-in BASIC instead of a cartridge). Plug the modem into RS-232 port 1 on the Atari 850 Interface Module. To work properly, the module must be switched on *before* you turn on the computer.

Next, if you're using a disk drive, before loading and running JTERM you must boot up with the RS-232 handler routine as an AUTORUN.SYS file on your DOS disk. The handler routine, included on your Atari DOS Master Diskette, allows the computer to address the RS-232 port on the interface module. Copy the handler routine from the DOS Master Diskette to your regular DOS system disk and give it the filename AUTORUN.SYS. This causes it to load and run automatically when you boot up.

Finally, load and run JTERM. It's normal for the screen to black out for a short period of time as the program initializes. When the first menu appears, JTERM is ready.

Note: For various reasons, Atari did not place the RS-232 handler routine in a very secure place in memory. If you exit BASIC to DOS after booting up, the handler will be overwritten. You must either have a MEM.SAV file on your disk or reboot the handler after making a DOS call. Furthermore, it appears that the NEW command damages or wipes out the handler as well. Therefore, you should always reboot the handler after using this command.

Selecting Menu Options

The first screen in JTERM tells you the size and location in RAM of the *text buffer.* The text buffer is an area of memory set aside so you can *upload* (transmit) and *download* (receive) files. The file, of course, can be text, a program, simple graphics, or merely a record of everything you send and receive when communicating with a remote computer. Naturally you can't upload or download a file larger than the buffer, unless you divide it into parts. The size and location of the buffer varies according to how much memory is installed.

This screen also presents the first menu choice, transmission speed. All menu choices in JTERM are made by simply typing the appropriate key highlighted in inverse video (type an ordinary character, not an inverse video one).

JTERM 3.8 now works with modems transmitting at either 300 or 1200 bits per second (bps), also referred to (less accurately) as 300 or 1200 baud. Remember that the modems at both ends of the phone connection must be transmitting and receiving at the same rate. If you aren't sure what the rate should be, the proper response is probably 300 bps.

Next, JTERM asks if you want to Download or Upload a file with the remote computer. If you want to communicate without transferring files, choose the Download mode.

Setting Translation And Parity

Now JTERM asks you to pick a translation setting. You can choose between No Translation, Light Translation, and ATASCII (Atari ASCII). This can get rather technical, so if in doubt, consult the section below on "General JTERM Guidelines." Most often, you'll probably choose Light Translation.

In the No Translation and ATASCII modes, the 850 Interface Module does not tamper with the characters as they're sent and received. (However, JTERM does some translation itself; more about that later.) With Light Translation, the high-order bits are stripped from all outgoing and incoming characters and the ATASCII end-of-line (EOL) character, 155, is changed to the ASCII carriage-return character, 13, during output, and vice versa during input.

The next choice is between the various settings of outgoing parity (incoming parity is not checked or changed by this program). You should always choose None if you've already selected No Translation, because setting the parity on output will change the high-order bit that you presumably wanted to preserve. This option is also rather technical, so if in doubt, choose None. The other parity options are included for those who wish to access mainframe computers that require certain parity configurations.

At this point, if you chose the Upload option, you'll be asked for the filespec (device and filename) of the file to be uploaded. When you press RETURN, the file is loaded into the buffer and listed on the screen as a check. JTERM then enters the terminal mode, where all communications take place. If you chose the Download option, JTERM enters the terminal mode immediately after you select the parity.

Terminal Operations

Whenever you enter the terminal mode, the word TERMINAL appears in inverse video at the top of the screen. You're now in the machine language portion of JTERM. If you've made all the right connections, you can start talking with the remote computer.

If you selected the Download option, you can switch the memory save function on and off by pressing the SELECT button; the flags MEMSTORE ON and MEMSTORE OFF are printed on the screen as you toggle back and forth. With MEMSTORE ON, everything you send and receive is captured in the text buffer. With MEMSTORE OFF, everything is lost as it scrolls off the screen. If the buffer fills up, the flag MEMORY FULL appears.

If you selected the Upload option, JTERM prevents you from switching MEMSTORE ON until after you've uploaded the file. This is a new feature of version 3.8. It prevents incoming characters from overwriting the buffer.

The OPTION button toggles between *full duplex* and *half duplex.* JTERM defaults to full duplex when you enter the terminal mode for the first time. That is, only the characters received from the remote computer are printed on the screen or captured in the buffer. This assumes that the remote computer echoes all the characters it receives. If the remote computer is operating in half duplex, it cannot send and receive simultaneously and does not echo the characters. Therefore, you won't be able to see your own typing. The solution is to switch to half duplex mode yourself by pressing the OPTION button. The flags HALF DUPLEX and FULL DUPLEX appear on the screen each time you press OPTION.

Leaving Terminal Mode

When you're ready to exit terminal mode, press the START button. One of three things will happen:

1. If you chose the Upload option and have not yet sent the file, JTERM immediately begins uploading. The flag UPLOADING appears on the screen and the buffer is transmitted, 25 characters at a time, to the computer at the other end of the line. You'll still see all incoming characters displayed on the screen, so if the remote computer is echoing your transmission you can watch the uploading in progress. When the transfer is complete, JTERM returns to the terminal mode as if you had selected the Download option from the menu.

2. If you chose the Download option and did not capture anything in the buffer with MEMSTORE ON, you'll return to the first menu. You can start another session with different parameters if you wish.

3. If you chose the Download option and captured anything at all in the buffer with MEMSTORE ON, the program asks you to type a filespec for the file you wish to save. (You can also press RETURN for further options—more about this in a moment.) If you enter a filespec, you can send the file to the cassette recorder (C:), the printer (P:), the screen editor (E:), or the disk drive (D:FILENAME). After you press RETURN, the file is sent to the appropriate device and JTERM lets you go back to terminal mode by pressing START.

If, however, you wish to save the buffer again (perhaps to a different device) before returning to terminal mode, press START and *before releasing the START button,* press OPTION. You'll be prompted for a filespec again. You can repeat this process as often as you want.

Now for those other options we mentioned. If you simply press RETURN at the filespec prompt, you get three alternatives. Pressing OPTION erases the buffer and returns you immediately to terminal mode without changing any parameters; pressing START erases the buffer and returns you to the menus, where you can change parameters; and finally, pressing SELECT returns you to the menus while *preserving* everything in the buffer.

Taking A Break

An additional feature of JTERM is its ability to send a break signal when you press the BREAK key. This flashes the screen, sounds a beep, prints the flag BREAK on the screen, and transmits a true break signal (approximately a half-second space tone).

The break signal is rarely needed when communicating with a BBS, since most of them don't recognize it anyway. But it can be essential when you're accessing a mainframe computer—there may be no other way to get its attention. Keep in mind, however, that the break routine passes briefly through BASIC. If you press BREAK a few times very quickly, you can trigger a standard program break and find yourself back in BASIC. If this happens, don't try to restart JTERM by typing RUN (it erased part of itself after initializing, remember). Instead, type GOTO 100.

A note to programmers about the BREAK key: If you've already studied the listing, you may have noticed the call in line 65 to the mysterious subroutine at line 2110. This subroutine was added when I discovered that the BREAK key doesn't perform the same way on different Atari computers. Actually, it's not the computer's fault—blame the 850 Interface Module. Whenever concurrent input/output is turned on, the RS-232 port handler substitutes its own interrupt handlers for the ones in the operating system ROM. This is necessary because concurrent input/output handles the serial bus interrupts differently than the operating system. Originally, the machine language portion of JTERM detected the BREAK key by sensing what the 850 interrupt handlers did with it. Of course, this was too good to last; later versions of the 850 handle the BREAK key by ignoring it.

So, the subroutine at line 2110 detects the presence of the newer interrupt handlers and installs a patch, if necessary, to make the BREAK key work as it should. This is a new feature of JTERM 3.8. Version 3.2 required users to remove a REM to activate the patch if needed. Now the program does this itself.

A warning: Do not renumber JTERM without modifying the subroutine in lines 2080–2100. This is the routine that erases all the DATA statements and initialization code after the program is run to conserve memory for the buffer. If you renumber the program without changing this routine, it will perform fatal surgery and whatever is left won't be of much use. (To find out how this routine works, see my article in *COMPUTE!'s Second Book Of Atari.*)

General JTERM Guidelines

The JTERM menus were designed for maximum flexibility when communicating with many different types of computers, terminals, and bulletin boards. This may cause some confusion, so here are some general guidelines:

Most often you will select 300 bps, Download, Light Translation, No Parity, and Full Duplex. This should work fine when communicating with information utilities such as CompuServe and The Source, as well as with most BBSs. If your modem and the equipment on the other end both have 1200 bps capability, you can select the faster 1200 bps speed. However, remember that some utilities such as CompuServe charge more for 1200 bps access.

For communicating between Atari computers, choose the ATASCII mode instead of Light Translation. This allows full compatibility between characters sent and received. Also select Half Duplex instead of Full Duplex.

For downloading TRS-80 graphics from a TRS-80 BBS, choose No Translation.

Usually you'll select None for the parity option unless you are communicating with a mainframe computer.

The half/full duplex option accomplishes with software what the half/full duplex switch on some modems does with hardware. It is included for those whose modems lack the duplex switch.

Technical Notes: Translations

When you choose between Light Translation, No Translation, or ATASCII in the third menu, you're setting the configuration of your 850 Interface Module RS-232 ports. You should read your 850 instruction manual for information about these configurations.

Even in the No Translation mode, JTERM does some translating of its own. First, nothing received through the port is changed at all before it's stored in memory. Therefore, if you choose ATASCII or No Translation, JTERM saves everything *exactly* as it was sent. Except for the ATASCII mode, however, there *is* some translation before characters are displayed on the screen. JTERM won't display control characters (ASCII values less than 32). This means that you will not see linefeeds, for instance; they will, however, be stored and can mess up a program you are downloading. You should *not* ask for linefeeds from the other computer; you do not need them even if the test messages are single-spaced.

The cursor-control keys will not work in these modes since they have ASCII values of 28, 29, 30; and 31. In addition, before displaying anything on the screen, JTERM translates the carriage-return character (ASCII 13) to the ATASCII EOL character, the printer bell character (ASCII 7) to the console bell (ATASCII 253), and the backspace character (ASCII 8) to the ATASCII DELETE/BACKSPACE (ATASCII 126). Again, none of this translation affects what is stored in memory; characters are stored exactly as they are received.

In ATASCII mode *everything* is sent to the screen as it is received, because JTERM assumes you are communicating with another Atari. JTERM won't translate any outgoing characters, either.

In the No Translation mode, two characters are changed. The DELETE/BACKSPACE character is changed to the ASCII backspace, so it does the same thing on most remote computers that it does on the Atari. And the RETURN key, or EOL, is changed to the ASCII carriage return before it is sent. In Light Translation the 850 module would do this automatically, but in No Translation it doesn't. I added this feature because I felt there were enough situations in which inverse video characters (ASCII values from 128 up) could be sent and received even though the host computer would still not recognize the EOL character.

In half duplex operation, outgoing characters sent to the port are returned to the input routine and handled just like any other incoming characters.

Additional Details

- When terminal mode is entered for the first time, the DTR line on RS-232 port 1 is set for modems that monitor this line.
- JTERM is designed to work with the Atari 850 module and the Atari RS-232 port handlers. It will also function with any equipment that properly emulates this system. JTERM works fine, for example, with the ATR8000 RS-232 port and the handlers included with MYDOS version 3.18.
- 1200 bps operation was added to JTERM 3.8 because these faster modems are becoming cheap enough for home computer users to afford. Even I bought one.
- Although it was not mentioned in the January 1983 article, JTERM 3.2 switched MEMSTORE OFF and changed to full duplex whenever the program cycled through BASIC. The same thing happened when you returned to the menus or even pressed the BREAK key. Now

these settings are preserved no matter what, even if the program is stopped and then restarted with GOTO 100.

- In ATASCII mode, JTERM 3.8 now lists *all* characters to the screen, including control characters. *However*, the screen editor does not respond to screen control characters (other than EOL) in three situations: (1) when a file to be uploaded is listed on the screen just after it has been loaded into the buffer; (2) during the upload process itself; (3) whenever you switch MEMSTORE ON in terminal mode. This feature was added by popular demand to make files being uploaded or downloaded easier to read on the screen. They now appear just as they do when you type LIST in BASIC.

JTERM For Atari

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
JO 15  DIM PROG$(383),PROG2$(7),SPO
       OL$(17),IN$(26),NORM$(4),ATA
       SCI$(4)
KG 20  CON=53279:POKE 559,0:POKE 20
       3,128:POKE 204,0:SVE=0
KO 25  FOR I=1 TO 4:READ A:NORM$(I,
       I)=CHR$(A):NEXT I
CD 30  FOR I=1 TO 4:READ A:ATASCI$(
       I,I)=CHR$(A):NEXT I
EA 35  DATA 201,13,208,4,162,0,240,
       24
BB 40  FOR I=1 TO 383:READ A:PROG$(
       I,I)=CHR$(A):NEXT I
IN 45  DIM MSG$(65):RESTORE 2000:FO
       R I=1 TO 65:READ A:MSG$(I,I)
       =CHR$(A):NEXT I
MO 50  DIM S$(5),T$(8),U$(9):FOR I=
       1 TO 5:READ A:S$(I,I)=CHR$(A
       ):NEXT I:FOR I=1 TO 8:READ A
       :T$(I,I)=CHR$(A):NEXT I
PP 55  FOR I=1 TO 9:READ A:U$(I,I)=
       CHR$(A):NEXT I:DIM BR$(7):FO
       R I=1 TO 7:READ A:BR$(I,I)=C
       HR$(A):NEXT I
JP 60  FOR I=1 TO 7:READ A:PROG2$(I
       ,I)=CHR$(A):NEXT I:FLAG=0
KP 65  GOSUB 2110
HF 70  GOSUB 2080:N=FRE(0)-256:DIM
       TXT$(N)
DN 100 SETCOLOR 2,9,0:PROG$(197,19
       7)=CHR$(13):PROG$(189,189)=
       CHR$(8):PROG$(271,274)=NORM
       $
EK 110 POKE 82,0:PRINT "{CLEAR}";
GC 120 PRINT N-1;" BYTES OF MEMORY
        AVAILABLE":PRINT "FROM-";A
       DR(TXT$);" TO-";ADR(TXT$)+N
       -2
JF 130 CLOSE #1:OPEN #1,4,0,"K"
JO 140 POKE 752,1:PRINT "{2 DOWN}
       {TAB}BAUD:":PRINT :PRINT "
       {TAB}";CHR$(193);" = 300":P
       RINT :PRINT "{TAB}";CHR$(19
       4);" = 1200"
JN 150 POKE 559,34:GET #1,ANS:IF A
       NS=ASC("A") THEN XIO 36,#4,
       0,0,"R":GOTO 180
LF 160 IF ANS=ASC("B") THEN XIO 36
       ,#4,10,0,"R":GOTO 180
GH 170 GOTO 150
AE 180 PRINT "{CLEAR}{2 DOWN}{TAB}
       Operation Mode:":PRINT :PRI
       NT "{TAB}";CHR$(196);"ownlo
       ad":PRINT :PRINT "{TAB}";CH
       R$(213);"pload"
EA 190 PRINT "{DOWN}{TAB}(or 1-4 f
       or disk file menu.)"
GH 200 POKE 752,0:GET #1,ANS:IF AN
       S=68 THEN UPLD=0:GOTO 240
IJ 210 IF ANS=85 THEN UPLD=1:GOTO
       240
OO 220 IF ANS>48 AND ANS<53 THEN T
       RAP 110:QQ=ANS-48:GOSUB 880
GA 230 GOTO 110
CF 240 POKE 752,1:PRINT "{CLEAR}
       {2 DOWN}{TAB}Translation Mo
       de:":PRINT :PRINT "{TAB}";C
       HR$(206);"one":PRINT :PRINT
        "{TAB}";CHR$(204);"ight"
BE 250 PRINT :PRINT "{TAB}";CHR$(1
       93);"TASCII"
FJ 260 POKE 752,0:GET #1,ANS:IF AN
       S=76 THEN MODE=0:GOTO 300
LC 270 IF ANS=78 THEN MODE=32:GOTO
        300
AN 280 IF ANS=65 THEN MODE=32:PROG
       $(197,197)=CHR$(155):PROG$(
       189,189)=CHR$(126):PROG$(27
       1,274)=ATASCI$:GOTO 300
GK 290 GOTO 240
KG 300 POKE 752,1:PRINT "{CLEAR}
       {2 DOWN}{TAB}Parity:":PRINT
        :PRINT "{TAB}";CHR$(206);"
       one":PRINT :PRINT "{TAB}";C
       HR$(207);"dd"
GL 310 PRINT :PRINT "{TAB}";CHR$(1
       97);"ven":PRINT :PRINT "
       {TAB}";CHR$(211);"et"
BD 320 POKE 752,0:GET #1,ANS:IF AN
       S=78 THEN PARITY=0:GOTO 370
DH 330 IF ANS=79 THEN PARITY=1:GOT
       O 370
DI 340 IF ANS=69 THEN PARITY=2:GOT
       O 370
DG 350 IF ANS=83 THEN PARITY=3:GOT
       O 370
GF 360 GOTO 300
KL 370 IF UPLD THEN GOSUB 590
JH 380 PRINT "{CLEAR}{2 TAB}";T$:P
       OKE 65,0:IF NOT FLAG THEN
       A=ADR(TXT$)
OA 390 CLOSE #2:OPEN #2,13,0,"R":X
       IO 38,#2,MODE+PARITY,0,"R":
       XIO 34,#2,192,0,"R":XIO 40,
       #2,0,0,"R"
HO 400 POKE 766,SVE:A=USR(ADR(PROG
        $),A,ADR(TXT$)+N-1,ADR(MSG$
        )):SVE=PEEK(766):POKE 766,0
        :IF PEEK(207)=128 THEN 700
OF 410  IF A=ADR(TXT$) AND  NOT UPL
        D THEN CLOSE #2:GOTO 100
KK 420  ON UPLD+1 GOSUB 490,760
BJ 430  IF UPLD THEN UPLD=0:TXT$=""
        :GOTO 380
IN 440  PRINT "PRESS ";S$;" TO RE-E
        NTER TERMINAL MODE"
PG 450  IF PEEK(CON)<>6 THEN 450
LL 460  IF PEEK(CON)=6 THEN 460
LE 470  IF PEEK(CON)=2 THEN 420
HA 480  GOTO 380
BK 490  CLOSE #2:? "{CLEAR}{4 DOWN}
        {TAB}ENTER OUTPUT FILENAME"
        :? "{TAB}1-4 FOR DISK FILE
        MENU":? "{4 SPACES}OR HIT <
        RETURN> FOR OPTIONS":? :? "
        {TAB}";
HC 500  POKE 702,64:POKE 65,3:TRAP
        670:INPUT SPOOL$:FLAG=0:IF
        SPOOL$<>"" THEN 560
EP 510  ? "{CLEAR}{2 DOWN}<START> e
        rases buffer; to menus":? "
        <SELECT> retains buffer; to
         menus":? "<OPTION> erases
        buffer; to terminal"
LC 520  I=PEEK(CON):IF I=5 THEN FLA
        G=1:GOTO 100
KD 530  IF I=6 THEN 100
KL 540  IF I=3 THEN 380
GK 550  GOTO 520
IK 560  TRAP 570:QQ=VAL(SPOOL$):IF
        QQ>0 AND QQ<5 THEN GOSUB 88
        0:GOTO 490
IB 570  TRAP 490:CLOSE #3:OPEN #3,8
        ,0,SPOOL$:IF SPOOL$(1,1)="E
        " THEN SETCOLOR 2,9,0
EF 580  TXT$(A-ADR(TXT$)+1)=" ":PRI
        NT #3;TXT$:CLOSE #3:RETURN
JK 590  PRINT "{CLEAR}{3 DOWN}{TAB}
        ENTER UPLOAD FILENAME":? "
        {TAB}OR 1-4 FOR DISK FILE M
        ENU":PRINT :PRINT "{TAB}";:
        POKE 702,64:INPUT SPOOL$:TX
        T$=""
JA 600  TRAP 610:QQ=VAL(SPOOL$):IF
        QQ>0 AND QQ<5 THEN TRAP 590
        :GOSUB 880:GOTO 590
KE 610  TRAP 670:CLOSE #3:OPEN #3,4
        ,0,SPOOL$:TRAP 4:POKE 65,3
KG 620  AD=ADR(TXT$):XX=INT(AD/256)
        :WW=AD-XX*256:ZZ=INT((N-1)/
        256):YY=(N-1)-ZZ*256
KI 630  IOCB=3:GOSUB 730:TXT$(QQ+1)
        =""
OE 640  IF PEEK(883)=136 THEN 660
HH 650  PRINT "ERROR ";PEEK(883);"
        DURING TEXT LOAD":STOP
EA 660  CLOSE #3:POKE 766,128:PRINT
         TXT$:FOR I=1 TO 500:NEXT I
        :POKE 766,0:POKE 203,255:RE
        TURN
EF 670  PRINT "{CLEAR}{4 DOWN}{TAB}
        UNABLE TO OPEN ";SPOOL$:PRI
        NT "{TAB}PRESS ";S$;" WHEN
        READY"
AA 680  IF PEEK(CON)<>6 THEN 680
ID 690  GOTO PEEK(186)+256*PEEK(187
        )-10
OJ 700  CLOSE #2:SETCOLOR 2,13,10:S
        OUND 0,30,10,15:XIO 34,#2,2
        ,15,"R":FOR I=1 TO 20:NEXT
        I:XIO 34,#2,3,0,"R"
PN 710  SOUND 0,0,0,0:SETCOLOR 2,9,
        0
LO 720  POKE 766,1:PRINT BR$:POKE 7
        66,0:GOTO 390
JN 730  POKE 834+IOCB*16,7:POKE 836
        +IOCB*16,WW:POKE 837+IOCB*1
        6,XX:POKE 840+IOCB*16,YY:PO
        KE 841+IOCB*16,ZZ
PO 740  K=USR(ADR(PROG2$),IOCB*16)
FO 750  QQ=PEEK(840+IOCB*16)+256*PE
        EK(841+IOCB*16):RETURN
HK 760  PRINT "{CLEAR}{4 DOWN}
        {2 TAB}";U$:POKE 766,1
KG 770  LL=LEN(TXT$):LN=INT(LL/25):
        LN=LN+(LL<>LN*25)
HK 780  FOR I=1 TO LN
DN 790  IF I=LN THEN PRINT #2;TXT$(
        (I-1)*25+1);:GOTO 810
FA 800  PRINT #2;TXT$((I-1)*25+1,I*
        25);
EA 810  STATUS #2,B:BY=PEEK(747):IF
         BY THEN GET #2,A:PRINT CHR
        $(A);:GOTO 810
ON 820  IF PEEK(CON)=3 THEN POP :PO
        KE 203,128:RETURN
CD 830  NEXT I
DP 840  FOR I=1 TO 20
EI 850  STATUS #2,B:BY=PEEK(747):IF
         BY THEN GET #2,A:PRINT CHR
        $(A);:GOTO 850
CG 860  NEXT I
CG 870  PRINT "{TAB}UPLOAD COMPLETE
        ":FOR I=1 TO 500:NEXT I:POK
        E 203,128:POKE 766,0:RETURN
HP 880  SPOOL$="D?:*.*":SPOOL$(2,2)
        =STR$(QQ):POKE 65,3:PRINT C
        HR$(125):CLOSE #5:OPEN #5,6
        ,0,SPOOL$:TRAP 900
PC 890  INPUT #5,SPOOL$:PRINT SPOOL
        $:GOTO 890
DI 900  CLOSE #5:PRINT "PRESS ";S$;
        " TO CONTINUE"
AB 910  IF PEEK(CON)=6 THEN RETURN
GO 920  GOTO 910
CB 1000 DATA 104,104,133,213,104,1
        33,212,104,133,215,104,133
        ,214,104,133,225,104,133,2
        24,169,0,133,207,172,31
HL 1010 DATA 208,192,7,240,115,192
        ,6,208,1,96,192,5,208,35,1
        72,31,208,192,5,240,249,16
        4,203,192,255
AD 1020 DATA 240,93,152,141,254,2,
        73,128,133,203,208,6,169,1
        2,133,217,208,36,169,25,13
        3,217,208,30,192
```

```
KE 1030 DATA 3,208,67,172,31,208,1
        92,3,240,249,164,204,152,7
        3,128,133,204,208,6,169,51
        ,133,217,208,4
EC 1040 DATA 169,38,133,217,24,165
        ,224,101,217,141,68,3,165,
        225,105,0,141,69,3,169,14,
        141,72,3,169
CN 1050 DATA 0,141,73,3,169,11,141
        ,66,3,162,0,32,86,228,169,
        0,240,2,240,134,173,252,2,
        201,255
PC 1060 DATA 240,54,162,32,169,11,
        157,66,3,169,0,157,72,3,15
        7,73,3,162,16,157,72,3,157
        ,73,3
IH 1070 DATA 169,7,157,66,3,32,86,
        228,201,126,208,4,169,8,20
        8,6,201,155,208,2,169,13,1
        62,32,32
CH 1080 DATA 86,228,164,204,208,50
        ,165,17,208,9,169,128,133,
        17,133,207,96,240,243,162,
        32,169,13,157,66
LL 1090 DATA 3,32,86,228,173,235,2
        ,201,0,240,163,169,7,157,6
        6,3,169,0,157,72,3,157,73,
        3,32
BA 1100 DATA 86,228,192,154,240,21
        0,164,203,208,10,162,0,129
        ,212,230,212,208,2,230,213
        ,201,13,208,4,169
PB 1110 DATA 155,208,20,201,7,208,
        4,169,253,208,12,201,8,208
        ,4,169,126,208,4,201,32,14
        4,22,160,11
PK 1120 DATA 140,66,3,160,0,140,72
        ,3,140,73,3,162,0,32,86,22
        8,165,203,208,142,165,215,
        197,213,144
PL 1130 DATA 16,240,2,208,132,165,
        214,197,212,144,6,240,4,16
        9,0,240,131,169,255,133,20
        3,165,224,141,68
KM 1140 DATA 3,165,225,141,69,3,16
        9,13,141,72,3,169,0,141,73
        ,3,169,11,141,66,3,162,0,3
        2,86
BA 1150 DATA 228,169,0,141,254,2,2
        40,213
AK 2000 DATA 155,205,197,205,207,2
        10,217,160,198,213,204,204
        ,155,205,197,205,211,212,2
        07,210
GH 2010 DATA 197,160,207,206,160,1
        55,205,197,205,211
LL 2020 DATA 212,207,210,197,160,2
        07,198,198,155,200,193,204
        ,198,160,196,213,208,204,1
        97,216,160,155
LM 2030 DATA 198,213,204,204,160,1
        96,213,208,204,197,216,160
        ,155
HO 2040 DATA 211,212,193,210,212
ND 2050 DATA 212,197,210,205,201,2
        06,193,204
BM 2060 DATA 213,208,204,207,193,1
        96,201,206,199,155,194,210
        ,197,193,203,155,104,104,1
        04,170,76,86,228
JN 2070 DATA 32,128,6,141,14,210,1
        69,0,133,17,96
AO 2080 POKE 842,13:? "{CLEAR}":PO
        SITION 2,6:FOR I=1000 TO 1
        150 STEP 10:? I:NEXT I:? "
        CONT":POSITION 0,0:STOP :L
        IST 100,260
JA 2090 ? "{CLEAR}":POSITION 2,6:F
        OR I=10 TO 65 STEP 5:? I:N
        EXT I:? "CONT":POSITION 0,
        0:STOP :LIST 100,260
LB 2100 ? "{CLEAR}":POSITION 2,6:F
        OR I=2000 TO 2150 STEP 10:
        ? I:NEXT I:? "G.2160":POSI
        TION 0,0:STOP
IH 2110 CLOSE #2:OPEN #2,13,0,"R":
        XIO 40,#2,0,0,"R"
AK 2120 IRQ=PEEK(534)+256*PEEK(535
        ):CLOSE #2
PA 2130 NWHAND=0:IF PEEK(IRQ+6)=18
        2 AND PEEK(IRQ+7)=35 THEN
        NWHAND=1
FK 2140 IF NWHAND THEN FOR I=1 TO
        3:READ A:POKE 8457+I,A:NEX
        T I:FOR I=1 TO 8:READ A:PO
        KE 1663+I,A:NEXT I
KI 2150 RETURN
DP 2160 POKE 842,12:RETURN
```

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IBM Pie Chart Maker

Michael Posner

This useful program takes the raw figures you enter (up to nine items) and automatically translates them into percentages to create perfectly proportioned pie charts, in color. It requires an Enhanced Model PCjr with Cartridge BASIC or a PC with a disk drive, BASICA, and the color/graphics adapter.

"IBM Pie Chart Maker" uses the medium-resolution graphics screen (SCREEN 1) to create easily understood pie charts. You need no programming ability to use Pie Chart Maker, and a help screen is always available.

If you want to generate a hard copy printout of a chart, be sure to load the DOS screen-dump utility after booting your system disk (type GRAPHICS at the DOS prompt with the DOS disk in the drive, before loading BASIC). Then, to make a screen dump, switch on the graphics printer and press SHIFT-PrtSc (press Fn-P on the PCjr).

Menu Options

When you run Pie Chart Maker, an option menu appears on the screen:

1 Create a pie chart
2 Save current chart
3 Load chart
4 Alter current chart
5 Clear current data
6 Print chart on screen
7 Help
8 Exit Pie Chart Maker

To perform one of the functions, press the corresponding number key.

Option 1 is described in detail in the next section.

Option 2, "Save current chart," asks you to specify a filename for the chart. When the file is saved, control returns to the menu.

Option 3, "Load chart," prompts for the filename of the chart you wish to load. After it is loaded, the menu reappears. Please note that loading a chart erases any chart in memory.

Option 4, "Alter current chart," lets you change data in a chart. Pie Chart Maker lists the current values and asks for the number to be changed. Enter this number, then the new value(s). These are substituted, and again the program asks for the number to be changed. Entering a zero returns you to the menu.

Option 5, "Clear current chart," erases the chart in memory. As a precaution, the program asks for verification before executing this command.

Option 6 prints the chart on the screen. As mentioned above, use the PrtSc key to reproduce the chart on the printer.

Option 7 calls up the help and instructions screen. Press the space bar to return to the menu.

Option 8 exits Pie Chart Maker and returns to BASIC. Again, the program asks for verification.

Creating A Pie Chart

Creating a pie chart is easy. Let's say you wish to chart the annual budget of a small computer company with the money distributed as follows:

Purpose	**Amount**
1. Research and Development	**$20,000**
2. Production	**$18,000**
3. Employee wages	**$13,000**
4. Advertising	**$11,000**
5. Other expenses	**$10,000**

The first prompt after selecting Option 1 on the menu is "Name of chart?" An appropriate entry would be "Annual Budget." For "Number of items?" you would enter the number 5. Pie Chart Maker accepts up to nine data items. For "Number 1?", enter 20,000, and for "Name 1?", enter R & D. Note that names longer than ten characters are shortened to ten in the print on screen mode. Enter the other four data items for the budget accordingly.

The next prompt asks, "Are you using a color monitor (0 = color, 1 = no color)?" Enter the appropriate answer. Then Pie Chart Maker exits to the menu.

Program breakdown:

20–90:	Set variables and error trap, go to menu.
100–250:	Create chart.
260–270:	See if chart is defined.
280–300:	Clear variables, draw main circle and initial ray.
310:	Set up main loop, choose color.
320–350:	Find point for line, draw line.
370–420:	Fill with PAINT.
440–500:	Fill with LINEs from center.
510–570:	Fill with arcs.
590–630:	Draw circle portions for key.
640–880:	Choose filler and fill circle portions.
890–950:	Print percentages, name of chart, return to menu.
960–1100:	Print options, go to selected option.
1110–1150:	Error trapping.
1160–1260:	Save chart.
1270–1340:	Load chart.
1350–1430:	Help and instructions screen.
1440–1580:	Alter data.
1590–1620:	Clear chart data.
1630–1660:	Exit to BASIC.
1670–1810:	Find percentages.

Variables:

XC	x coordinate of main circle.
MR	radius of main circle.
XK	x coordinate of circle portions of key.
PX	x coordinate for placing percentage.
XL	x coordinate for placing data name.
CL,SL	point on circle to which ray is drawn.
NG$	name of graph.
CV	color: 0=yes, 1=no.
N	number of items.
XL(N)	datum number n.
X(N)	percentage for datum number n.
N$(N)	name for datum number n.
YP(N)	coordinate for n$(n) (percent printed at YP-1).

Programming Notes

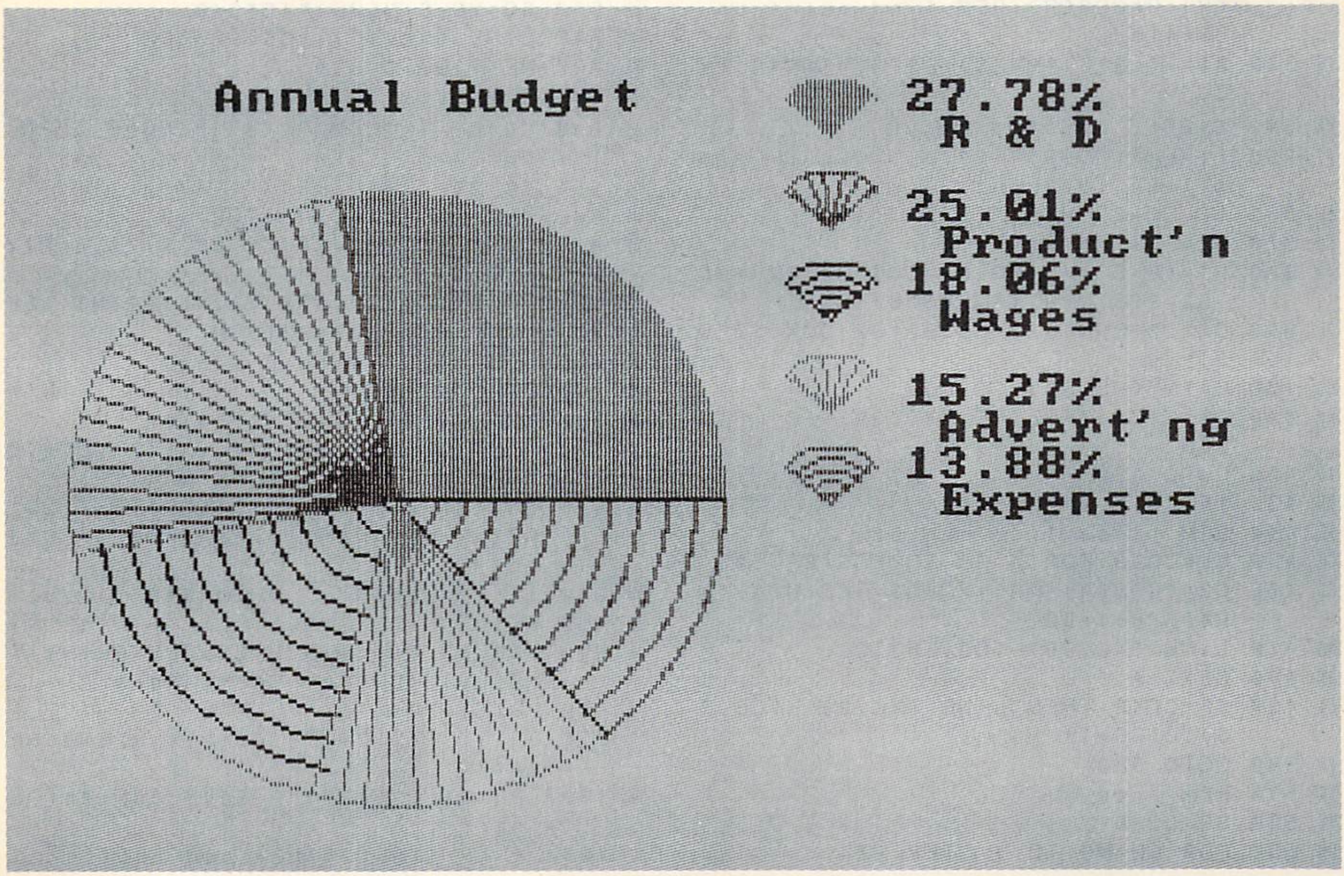
Pie Chart Maker first computes the percentage of each figure you enter. Then it draws the main circle. It converts percentages to degrees, and then to radians. The BASIC trigonometry functions sine (sin) and cosine (cos) are used to segment the main circle according to the percentages computed for the various data items. As each portion is drawn, it is filled in one of three ways. The PAINT statement of BASIC is the first choice. A second choice is a series of rays from the center of the circle to the edge. Third is arcs of decreasing radii. All these may be done in three colors.

Next, the program prints the key at the right of the screen. The circle portions are plotted using a circle command within a FOR-NEXT loop, and then are filled in the same way as the portions of the main circle they represent. Finally, the program prints the percentages and labels.

IBM Pie Chart Maker

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing this program in.

```
GC 20 KEY OFF:ON ERROR GOTO 1110
PK 30 XC=99:MR=80:XK=205:PX=29:XL=30
EO 40 FOR X=1 TO 9:READ A:YP(X)=A:NEXT
```



```
       :REM y coordinate for chart I.D.
IA 50 DATA 3,6,8,11,13,16,18,21,23
CA 60 FOR X=1 TO 9:READ Y:C(X)=Y:NEXT:
      REM color and type of filler
CE 70 DATA 1,5,9,4,8,3,7,2,6
PP 80 PI=3.141593
PO 90 GOTO 960
FG 100 CLS:PRINT TAB(34)"Create chart"
PD 110 PRINT:PRINT
OJ 120 INPUT"Name of chart ";NG$
OI 130 NG$=LEFT$(NG$,26)
KK 140 INPUT"Number of entries (2-9)";
       N
IF 150 IF N>9 OR N=0 THEN 100
JO 160 FOR X=1 TO N
MD 170 PRINT"Number"X;:INPUT X1(X)
BI 190 PRINT"Name"X;:INPUT N$(X)
DB 200 IF N$(X)="" THEN N$(X)=N$(X-1)
GA 210 NEXT X
KJ 220 INPUT"Are you using a color mon
       itor (0=Y,1=N)";Y$
JN 230 CV=VAL(Y$)
HE 240 GOSUB 1670
MG 250 RETURN
NC 260 IF N<>0 THEN 280
NC 270 PRINT:PRINT"No chart defined":F
       OR Z=1 TO 2000:NEXT:RETURN
MA 280 S=0:CO=0:R=0:S1=0:C1=0:CO=0:S2=
       0:C2=0:CR=0:RO=0:SP=0:D=0
HE 290 SCREEN 1,0:IF CV=0 THEN SCREEN
       1,1
EL 300 LINE (XC,99)-(XC+MR,99),1
AF 310 CS=0:FOR X=1 TO N:CS=CS+1:CO=C(
       CS)
BA 320 D=3.6*X(X)+D:R=D*(PI/180):S=SIN
       (R):C=COS(R):REM find point on
       circle
IH 330 S1=-((5/6)*MR*S)+99:C1=(MR*C)+X
       C
NM 340 CIRCLE (XC,99),MR,CO
IJ 350 LINE (XC,99)-(C1,S1),CO:REM dra
       w line to point
BM 360 IF CO>3 THEN 430
GD 370 REM paint area
JG 380 R1=(R-RO)/2+RO:C2=COS(R1)*MR+XC
       :S2=-(SIN(R1)*MR*5/6)+99
JE 390 C2=C2-SGN(C2-XC):S2=S2-SGN(S2-9
       9)
GC 400 PAINT(C2,S2),CO,CO
KH 410 CN=C(CS+1):LINE (XC,99)-(C1,S1)
       ,CN
ID 420 GOTO 580
CH 430 IF CO>6 THEN 520
PE 440 REM lines from center
CK 450 CL=CO-3:FOR A=RO TO R STEP .08
GD 460 C3=(COS(A)*MR)+XC:S3=-(SIN(A)*M
       R*(5/6))+99
BG 470 LINE (XC,99)-(C3,S3),CL
JK 480 NEXT A
EB 490 IF CL<3 THEN LINE (XC,99)-(C3,S
       3),C(CS+1)
IA 500 GOTO 580
IM 510 REM arcs
MG 520 SP=CO-6
CM 530 FOR CR=MR TO 1 STEP -7
FM 540 IF R>2*PI THEN R=2*PI
KP 550 CIRCLE (XC,99),CR,SP,RO,R
CB 560 NEXT CR
GI 570 IF SP<3 THEN LINE (XC,99)-(C1,S
       1),C(CS+1)
HG 580 RO=R:NEXT X:CIRCLE (XC,99),MR,3
       :CIRCLE (XC,99),MR+1,3
DH 590 REM draw circle portions for ke
       y
CD 600 FOR C=20 TO (N-1)*20+20 STEP 20
CH 610 CK=C(C/20):CK=CK-(3*INT(CK/3)):
       IF CK=0 THEN CK=3
DM 620 CIRCLE (XK,C),15,CK,-PI/4,-3*PI
       /4
OI 630 NEXT
KB 640 FOR Z=1 TO N
HI 650 CM=C(Z):IF CM<4 THEN GN=1:GOTO
       680
OH 660 IF CM>6 THEN GN=3:GOTO 680
CG 670 GN=2
OP 680 ON GN GOSUB 720,760,840:REM CHO
       OSE FILLER FOR PORTION
OE 690 NEXT
FC 700 GOTO 900
MM 710 REM paint portion
LK 720 CC=CM-INT(CM/3)*3:IF CC=0 THEN
       CC=3
DM 730 YC=15+(20*(Z-1))
CE 740 PAINT (XK,YC),CC,CC:GOTO 880
OJ 750 REM lines from center
LC 760 CC=CM-INT(CM/3)*3:IF CC=0 THEN
       CC=3
BP 770 YC=20+(20*(Z-1))
NP 780 FOR RC=PI/4 TO 3*PI/4 STEP .3
HM 790 CS=COS(RC)*15+XK
EH 800 SC=YC-SIN(RC)*15*5/6
MB 810 LINE (XK,YC)-(CS,SC),CC
MI 820 NEXT:GOTO 880
ID 830 REM arcs
LP 840 CC=CM-INT(CM/3)*3:IF CC=0 THEN
       CC=3
BM 850 YC=20+(20*(Z-1))
OP 860 FOR CR=12 TO 2 STEP -3
DB 870 CIRCLE (XK,YC),CR,CC,PI/4,3*PI/
       4:NEXT
EO 880 YP=YP(Z):LOCATE YP,XL:PRINT LEF
       T$(N$(Z),10):RETURN
BN 890 REM print percentages
KM 900 FOR Z=1 TO N
DM 910 YP=YP(Z):LOCATE YP-1,PX
GA 920 PRINT USING"###.##";X(Z):LOCATE
        YP-1,PX+6:PRINT "%":NEXT
HB 930 GO=(27-LEN(NG$))/2:LOCATE 2,GO:
       PRINT NG$:REM print name of gra
       ph
NM 940 IF INKEY$<>" " THEN 940
NN 950 RETURN
HF 960 SCREEN 0,0:WIDTH 80:CLS:PRINT T
       AB(29)"IBM Pie Chart Maker"
BJ 980 PRINT:PRINT
PP 990 PRINT TAB(29)"1-Create a pie ch
       art"
DG 1000 PRINT TAB(29)"2-Save current c
        hart"
JC 1010 PRINT TAB(29)"3-Load chart"
```

```
LA 1020 PRINT TAB(29)"4-Alter current
        chart"
EB 1030 PRINT TAB(29)"5-Clear current
        data"
LG 1040 PRINT TAB(29)"6-Print chart on
         screen"
KC 1050 PRINT TAB(29)"7-Help"
MB 1060 PRINT TAB(29)"8-Exit Pie Chart
         Maker"
ND 1070 PRINT:PRINT:PRINT"Enter functi
        on number:";
LN 1080 F=VAL(INKEY$):IF F<1 OR F>8 TH
        EN 1080
PO 1090 ON F GOSUB 100,1160,1270,1440,
        1590,260,1350,1630
HI 1100 GOTO 960
KC 1110 IF ERL=1300 THEN RESUME 1270
JM 1120 IF ERL=140 THEN PRINT CHR$(30)
        :RESUME 140
CA 1130 IF ERL=170 THEN PRINT CHR$(30)
        :RESUME 170
NF 1140 IF ERL=1470 THEN PRINT CHR$(30
        ):RESUME 1470
MA 1150 ON ERROR GOTO 0:END
FH 1160 SCREEN 0,0:CLS:PRINT TAB(35)"S
        ave chart"
AB 1170 IF N<>0 THEN 1200
KN 1180 PRINT"No chart currently defin
        ed"
PF 1190 FOR X=1 TO 1500:NEXT:RETURN
FC 1200 PRINT:INPUT"Filename to save c
        hart";NS$
GM 1210 FOR Z=1 TO LEN(NS$):IF MID$(NS
        $,Z,1)<>" " THEN NEXT:GOTO 123
        0
AH 1220 PRINT"Please put no spaces in
        filename.":GOTO 1200
ME 1230 OPEN NS$ FOR OUTPUT AS #1
BF 1240 PRINT #1,N:PRINT #1,N$:PRINT #
        1,CV:PRINT #1,NG$
GL 1250 FOR S=1 TO N:PRINT #1,X1(S):PR
        INT #1,N$(S):NEXT
OJ 1260 CLOSE #1:RETURN
DA 1270 SCREEN 0,0:CLS:PRINT TAB(35)"L
        oad chart"
DN 1280 PRINT:PRINT:FILES
LA 1290 PRINT:PRINT:INPUT"Filename of
        chart";NL$
GG 1300 OPEN NL$ FOR INPUT AS #1
KB 1310 INPUT #1,N:INPUT #1,N$:INPUT #
        1,CV:INPUT #1,NG$
NA 1320 FOR L=1 TO N:INPUT #1,X1(L):IN
        PUT #1,N$(L):NEXT
BO 1330 CLOSE #1:GOSUB 1670
JM 1340 RETURN
DP 1350 CLS:PRINT TAB(23);"IBM Pie Cha
        rt Maker Help & Instructions"
JP 1360 PRINT:PRINT"     This graph uti
        lity makes pie charts from dat
        a you provide. From the menu,
          press <1> to create a chart.
          Enter the name of chart, num
        ber of items, and theneach dat
        a item, along with a name to i
        dentify it.
NO 1370 PRINT:PRINT"     Other function
        s include:  saving or loading
        a chart, altering data, cleari
        ng data, printing to screen, o
        r exiting the program."
MK 1380 PRINT:PRINT"     To perform on
        e of the above functions, pres
        s the space bar while your cha
        rt is on the screen.  This wil
        l take you to the menu.  Then
        press the number of   the func
        tion you wish to execute."
CM 1400 PRINT:PRINT"     While your cha
        rt is on the screen, hold down
         SHIFT and press PrtSc to send
          the chart to the printer (pr
        ess Fn-P on the PCjr)."
GJ 1410 LOCATE 23,25:PRINT"(Press spac
        e bar to continue)"
MP 1420 IF INKEY$<>" " THEN 1420
JM 1430 RETURN
KK 1440 CLS:PRINT TAB(35)"Alter data"
NH 1450 PRINT:PRINT:PRINT"# 1 = "NG$"
        (name of chart)":PRINT"# 2 ="C
        V;:PRINT"(0=color/1=no color)"
        :FOR AD=1 TO N
GB 1460 PRINT"#"AD+2"="X1(AD)", "N$(AD
        ):NEXT
PO 1470 PRINT:INPUT"Input # to change
        (0 to exit)";NC
OP 1480 IF NC=0 THEN 1570:IF NC<1 OR N
        C>N+3 THEN 1470
OL 1490 IF NC>2 THEN 1540
OH 1500 INPUT"Enter new data";NN1$
PO 1510 IF NC=1 THEN NG$=NN1$
BL 1520 IF NC=2 THEN CV=VAL(NN1$)
ON 1530 GOTO 1440
NB 1540 INPUT"Enter new value (number,
          name)";NN1$,NN2$
BI 1550 NN=VAL(NN1$):X1(NC-2)=NN:N$(NC
        -2)=NN2$
OG 1560 GOTO 1440
OI 1570 GOSUB 1670
KN 1580 RETURN
DL 1590 SCREEN 0,0:CLS:PRINT TAB(35)"C
        lear data"
EM 1600 PRINT:PRINT:INPUT"Are you sure
        ";S$
OE 1610 IF S$<>"y" AND S$<>"Y" THEN RE
        TURN
GG 1620 RUN 20
BI 1630 CLS:PRINT TAB(35)"Exit to BASI
        C"
FI 1640 PRINT:PRINT:INPUT"Are you sure
        ";S$
PA 1650 IF S$<>"y" AND S$<>"Y" THEN RE
        TURN
BG 1660 SCREEN 0,0:WIDTH 80:CLS:END
BK 1670 REM compute percentages
ML 1690 SU=0:FOR M=1 TO N:SU=SU+X1(M):
        NEXT
MF 1700 X1(Z)=0:FOR Z=1 TO N:X(Z)=X1(Z
        )/SU*100:NEXT
JC 1730 RETURN
```

©

Random Access DATA Statements For Apple

Robert Jacques Beck

By adding this short routine to your programs, you can gain random access to any piece of information stored in DATA statements—a powerful and useful technique: It works on all Apple II-series computers with either DOS 3.3 or ProDOS.

Any byte in Random Access Memory (RAM) can be immediately accessed during a read or write by specifying its address. *Random access* data files offer the same type of quick access: You locate records by specifying record numbers. Records may be retrieved in any order.

Serial, or *sequential,* access is based on the principle of starting with the first record and counting up to the one you want. Sequential access is usually slower than random access. While it takes approximately the same amount of time to read any record in an Applesoft random access file, the time required to read an identical record in a sequential file increases as the record is placed towards the file's end. This is because DOS must traverse each record in the file to count end-of-record marks until it locates the record it is searching for.

DATA statements in BASIC provide an in-memory sequential access file. You begin by reading the first DATA statement, and you move sequentially through the data list with each successive READ.

Until I figured out the technique described in this article, I'd always been annoyed at the rigidity of DATA statements. They're fine if you want to access your data the same way your DATA statements are organized, but they are difficult to use any other way within the confines of BASIC. Some BASICs use the RESTORE command to reset a pointer to the beginning of the data, but that's not where you always want to go. A few BASICs, such as Atari BASIC, let you RESTORE to a specific line number or even a variable, providing much more flexibility. But many BASICs (including Applesoft) lack this feature.

You can get flexibility by reading all your DATA statements into arrays and using an index to grab array elements. But storing variables as data and as arrays can be costly in terms of memory. Another approach is to read through the data each time until you get to the element you want, using code such as this:

```
10 RESTORE
20 FOR I = 1 TO N
30 READ INFO
40 NEXT I
```

After these lines have been executed, the variable INFO is equal to the Nth data element. The major disadvantage of this method is its slowness.

Flexible Data

Fortunately, there are a couple of zero-page pointers that let us manipulate the READ operation. The two short programs included here illustrate how to pull variables directly out of DATA statements as if they were in random access files.

In the Apple, decimal locations 123 and 124 (hexadecimal $7B and $7C) store the line number of the last DATA statement read. Locations 125 and 126 point to the data's absolute memory location. The pointers are stored in the usual Apple fashion; that is, the first memory location is the low byte (lower two hexadecimal digits) and the second memory location is the high byte (upper two hexadecimal digits). To translate the information in the pointers into a line number that makes some sense, use this formula:

```
LN = PEEK(123) + PEEK(124)*256
```

It may seem strange that the upper two digits are both multiplied by 256 when you convert to decimal. After all, while one of the digits is the 256 digit, the other is the 4096 digit (just as the third and fourth digits in a decimal number represent hundreds and thousands). But since Applesoft multiplies a byte's upper digit by 16 when you PEEK, and since 4096 = 16*256, you don't have to convert each digit separately.

Back to the pointers. Unfortunately, you can't use the line number pointer to do anything. It's just a tag-along to the memory pointer: To move from one data location to another, that's the pointer you'll need to adjust. There are a couple of ways to go about it.

Random Languages

Program 1 prints a memory location table of all the stuff in your DATA statements. Lines 60000 and 60010 print the table's heading. Line 60015 stops the program after the last of the DATA statements are read; line 60020 reads the DATA one variable at a time. Line 60030 calculates the pointer location just after a READ and line 60040 calculates the current line number. Line 60050 checks to see if the current line number is the same one which was just read—if it isn't, the position index (I = a variable's position within a DATA statement) is initialized. Line 60060 prints the table, one row at a time. Just tack these lines onto your program, anywhere after the last DATA statement. If you use the line numbers from Program 1 (60000–60090), then RUN 60000 to get your table.

Program 2 is a whimsical little program that shows one way to use the information from Program 1. Lines 70 to 100 read and print a list of three languages in English. Line 50 reads some memory locations into the array ML. These memory locations were obtained from Table 1. Pick which language you want the list printed in next. Line 115 sets the variable LOC to the memory location of the appropriate DATA statement. Lines 120 and 130 break the memory location into high and low bytes, then lines 140 and 150 reset the pointer so the list will be read from the correct DATA statement.

No matter how many times you cycle through the program, you'll always get the list printed in the language you want, and you'll never get an END OF DATA message.

The table is what Program 1 does when attached to Program 2. Since the locations are calculated *after* a READ, to locate a variable use the value from the immediately preceding variable.

An alternate method is to add or subtract the difference between the pointer's current value and new value it must have in order to point to a variable. Try these changes in Program 2:

```
10 DATA ENGLISH,-32,SPANISH,0,FRENCH,38
20 DATA INGLES,-75,ESPANOL,-38,FRANCES,0
30 DATA ANGLAIS,-114,ESPAGNOL,-82,FRANCAIS,-39
40 REM
50 REM
80 READ A$(I),ML(I)
115 LOC = ML(W) + PEEK (125) + PEEK (126)*256
```

Line 80 now reads not only the variable, but also a number that is added to the pointer in line 115. The advantage here is that we're relying on the separation between variables, rather than their actual memory locations.

Insert the three DATA statements into the program anywhere you wish. As long as you don't change the relative position of any data, you can edit the program without affecting how the data is handled.

Line No.	Position	Location	Variable
10	1	2058	2068
10	2	2063	2096
10	3	2068	2124
20	1	2081	ENGLISH
20	2	2089	SPANISH
20	3	2096	FRENCH
30	1	2108	INGLES
30	2	2116	ESPANOL
30	3	2124	FRANCES
40	1	2137	ANGLAIS
40	2	2146	ESPAGNOL
40	3	2155	FRANCAIS

Generated By Combining Program 1 and Program 2

Program 1: Random Access DATA— Table Generator

```
60000  PRINT "LINE #" SPC( 3)"POSITION"
     SPC( 3)"LOCATION" SPC( 3)"VARIABL
    E
60010  FOR I = 1 TO 40: PRINT "-";: NEXT
    : PRINT
60015  ONERR  GOTO 60090
60020  READ A$
60030 LOC =  PEEK (125) +  PEEK (126) *
    256
60040 NL =  PEEK (123) +  PEEK (124) *
    256
60050  IF NL <  > LN THEN I = 1:LN = NL

60060  PRINT NL SPC( 10 -  LEN ( STR$ (
    LN)))I SPC( 10 -  LEN ( STR$ (I)))
    LOC SPC( 11 -  LEN ( STR$ (LOC)))A
    $
60070 I = I + 1
60080  GOTO 60020
60090  END
```

Program 2: Random Access DATA— Demonstration

```
10   DATA 2068,2096,2124
20   DATA ENGLISH,SPANISH,FRENCH
30   DATA INGLES,ESPANOL,FRANCES
40   DATA ANGLAIS,ESPAGNOL,FRANCAIS
50   READ ML(1),ML(2),ML(3)
60   HOME
70   FOR I = 1 TO 3
80   READ A$(I)
90   PRINT I SPC( 3)A$(I): PRINT
100   NEXT
110   INPUT "WHICH ONE?";W
115 LOC = ML(W)
120 HB =  INT (LOC / 256)
130 LB = LOC - HB * 256
140  POKE 125,LB
150  POKE 126,HB
160  GOTO 60
```

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MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Multiplication
Part 1

Many microprocessors don't have a multiplication instruction, including the 6502. But to do math, to efficiently handle tables, or even to input a multidigit number, a program must be fruitful, and multiply.

Classic Simplicity

The easiest way to perform multiplication is repeated addition. This is much too simple, and we tend to avoid it. Yet for very small numbers it can be reasonably efficient. If you have a small number in X and wish to multiply the contents of address $0390 by X, placing the results into addresses $0391 (high) and $0392 (low), you might code:

```
        LDA   #$00
        STA   $0391
LOOP    CPX   #$00
        BEQ   EXIT
        DEX
        CLC
        ADC   $0390
        BCC   LOOP
        INC   $0391
        BCS   LOOP
 ; complete the job here
EXIT    STA   $0392
```

It's very simple. If the result is known to fit into a single byte, the coding can be shortened even more. If X contains a high value, however, this kind of program becomes time-consuming.

To examine the classic method of multiplication, we should try an example in decimal notation to see how it works:

```
      2 4 6
×     1 2 3
-----------
      7 3 8
    4 9 2
  2 4 6
-----------
  3 0 2 5 8
===========
```

The steps are: multiplying (by each digit), shifting over to a new column, and addition. Exactly the same steps will be used in binary, but they become simpler. Multiplication will be either times 0 or times 1 (giving zero or the original multiplicand). Shifting a column changes to shifting a bit; this could be a left or right rotation depending on which way we're going. And addition can be performed by the ADC command as we generate the various intermediate products. Let's look at some simple binary multiplication.

Multiplying Bits

```
            1 1 0 1 0
                1 0 1
---------------------
(a)         1 1 0 1 0
(b)       0 0 0 0 0
(c)     1 1 0 1 0
---------------------
    1 0 0 0 0 0 0 1 0
=====================
```

The decimal equivalent of this multiplication is 26 × 5 equals 130; but it's more interesting to see the binary workings. The intermediate values that we add (lines a and c) correspond to the original multiplicand, appropriately shifted. There's a zero in there too (line b), but a multiplication program wouldn't go to the trouble of adding zero. Instead, it would skip the addition.

It doesn't matter in principle if we shift the multiplicand left or right; we'll end up with the same result. In practice, we usually employ a trick. We don't shift the multiplicand at all; instead, we shift the *product* as it is generated. Thus, we would work the above example backwards: We would start with line (c) and put the value 11010 into the product area. Backing up to line (b), we'd shift the product left (giving 110100). The appropriate multiplier bit would be zero, so we'd skip the addition. Back up to line (a), shifting the product again (and getting 1101000). Now we spot a 1 bit at the right of the multiplier, so we add the multiplicand once again; 1101000 plus 11010 gives 10000010, our answer.

We'll talk more about the general multiplication procedure next time. By extracting the same logic for specific numbers, we can generate very fast multiplication algorithms.

For example, often you'll need to multiply a number by ten decimal. If a program receives decimal values typed in by the user, each digit will be added to the previous value times ten. Example: If the user has typed in 23 and now types 4, the 23 must be multiplied by ten to give 230; then we add the 4 to get 234.

A Shifty Solution

Let's examine the binary representation for ten decimal: 1010. If we keep in mind the procedure described above, we can do the job easily. Start with the high bit (1, of course). Starting with a product of zero, add in the value to be multiplied by ten. (For the sake of example, let's say that it is 23.) Shift it left; since the next bit is a zero, we won't add. Shift it left again (by this time the 23 has achieved a value of 92); the next bit of the multiplier is a 1, so we add the original value of 23 (giving 115). Shift left again; the final bit is zero, so no addition. Result: 230.

You might like to try your hand at working through the logic of multiplying by 60—binary 111100. It ends up as add (or load); shift-add; shift-add; shift-add; shift; shift.

Shifts become "long shifts" when applied to numbers over one byte long. ASL becomes ASL-ROL for two bytes, or ASL-ROL-ROL for three bytes. Depending on the programmer's knowledge of the values, it may be necessary to check for overflow—the result may be too big to fit the space provided.

Let's write a simple routine for a Commodore machine to input a two-digit decimal number. We'll need to multiply the first digit by ten.

```
 ; print question mark
        LDA    #$3F
        JSR    $FFD2
 ; get first digit
DIG1    JSR    $FFE4
 ; reject illegal keys
        CMP    #$30
        BCC    DIG1
        CMP    #$3A
        BCS    DIG1
 ; echo and convert to binary
        JSR    $FFD2
        AND    #$0F
 ; store in work area; multiply by ten
        STA    $0380
        ASL    A
        ASL    A
        ADC    $0380
        ASL    A
```

Note that we don't need to check for overflow or clear the carry flag before addition. We know the digit is less than ten; we know that the shifts will produce values well within one byte's range, and that the carry will be cleared by the shifts.

```
 ; store results; get next digit
        STA    $0380
DIG2    JSR    $FFE4
 ; reject illegal keys
        CMP    #$30
        BCC    DIG2
        CMP    #$3A
        BCS    DIG2
 ; echo and convert to binary
        JSR    $FFD2
        AND    #$0F
 ; add previous digit
        CLC
        ADC    $0380
```

The two-digit number is now a binary value in the A register. The program will probably continue by storing it somewhere. There's no ambiguity on size: The result fits within one byte, since it can't be over 99.

Next month we'll talk about general multiplication: any number by any other number. ©

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Arlan R. Levitan

Smokey & The Modem—Part 8086

I live in the greater Detroit area, a hotbed of muscle cars and micros. In this town it's hard to miss the fact that America's involvement with microcomputers shares a lot of overtones with its longstanding love affair with the automobile.

The image of T-shirted car enthusiasts discussing the displacement and horsepower of their chariot engines while Bruce Springsteen tunes play in the background comes readily to mind when you hear the name *Motown.* But in this and other towns, you're just as likely to find corporate and casual computer users congregating and speaking in reverent tones about the capacity of their hard disks and the cycle times of their central processing units.

Motor cars and micros. Both encourage a fascination with speed and power. And while General Motors, Ford, Chrysler, and American Motors are still fighting a pitched battle against foreign manufacturers for the hearts and minds of the car-buying public, IBM, Apple, Commodore, Tandy, and Atari are girding themselves for an expected onslaught of Japanese MSX-standard computers.

The marketing type who coined the term "power user" to describe personal computer owners who can't get enough memory or a fast enough CPU had a firm grip on the ego-related realities of the micro market. Reminding an avid power user that faster processors, massive mass storage, and megabyte memories don't necessarily let you write text or enter spreadsheet data twice as fast is about as fruitful as discussing the 55 mph speed limit with the owner of a 1967 Plymouth Road Runner running a Hemi-Head engine.

Souped-Up Modems

All this discussion of speed has a point. I've received a number of inquiries from readers about what kind of modem they should purchase. In particular, there seems to be a lot of interest in the new high-speed 2400 bits per second (bps) modems appearing on the scene.

The major factor which determines the price of a modem is the maximum speed at which it can send and receive data over the phone lines. A low-speed modem's top rate is 300 bps, equivalent to about 30 characters per second. These modems range in price from $50 to $280, depending on what other features are included. They're often referred to as *Bell 103-compatible* (Bell 103 is a phone company standard).

Bell 212-compatible modems can handle data transmissions at both 300 and 1200 bps. They used to cost $500 to $700, but recent developments in chip technology have allowed several manufacturers—notably Anchor Automation and Qubie Corporation—to break the $300 price barrier with full-featured 300/1200 bps modems. Industry projections indicate that by 1986, these medium-speed modems will dominate the consumer market and typically list for under $200.

The new kids on the block are the 2400 bps modems. Although they are twice as fast as 1200 bps units and operate on standard voice-grade phone lines, they also command a premium price ($800 to $1,500). Sometimes these 2400 bps modems are referred to as *CCITT (Consultative Committee on International Telephony and Telegraphy) V.22* units—by those who own the Telecommunications Edition of *Trivial Pursuit.* Some 2400 bps units are also capable of 1200 and 300 bps transmission.

The terms *high, medium,* and *low* speed refer to transmissions over regular (voice-grade) telephone lines, the kind you have in your home. True high-speed transmissions aren't practical on these lines. Instead, specially prepared *conditioned* lines are required by businesses which transmit data at rates from 9600 to 57,600 bps. Both the conditioned lines and the high-speed modems are expensive and are limited to point-to-point transmissions. The line is permanently installed between two locations and cannot be used to access the regular telephone network. Of course, conditioned lines are out of the question for most of us.

Judging A Modem By Its Baud

You'll often see the term *baud* when reading about transmission speeds. Modems will be advertised as "1200 baud" or "2400 baud." But strictly speaking, this is an improper use of terminology. Baud (named after Georges Baudot, a telecommunications pioneer) is used to describe the division of each second into tiny, discrete pieces (also called *signal modulation*) by a modem's electronic circuitry.

A 300 bps modem's signal is indeed modulated at 300 baud. Since each tiny division holds one bit of data, the effective transmission rate is calculated as 300 baud per second times one bit per baud, or 300 bits per second (bps).

Things take a different turn with 1200 bps modems. You might expect each second to be divided into 1200 pieces. This is not the case. A 1200 bps modem actually divides each second into 600 pieces. Using a technique called four-level phase shift keying (psk for short), each piece can represent a string of two bits.

This isn't as complicated as it may seem. All it means is that by using a method that plays with the phase characteristics of the modem's signal, each baud can be in one of four binary phases, namely:

00 or 01 or 10 or 11

There you have it. Each baud can be in one of four phases, with each representing exactly two bits. Multiply 600 baud per second times two bits per baud and *voilà*! You get 1200 bits of information per second (1200 bps).

Even More Bits Per Baud

Knowing this, it may come as no surprise to learn that 2400 bps modems also use a modulation rate of 600 baud. What is different is the method of phase shift keying. A 2400 bps modem uses a method that yields 16-level phase shift keying, so each piece or baud can represent a string of four bits:

0000 0001 0010 0011
0100 0101 0110 0111
1000 1001 1010 1011
1100 1101 1110 1111

So with a 2400 bps modem, each baud can be in one of 16 phases, with each representing exactly four bits. Multiply 600 baud per second times four bits per baud and we get (drumroll, please . . .) 2400 bits of information per second.

That's why you should avoid terms like *1200 baud* and *2400 baud* when describing modems. Both are actually 600 baud units which use clever schemes to pack more than one bit per baud. Use *bits per second* (bps) instead.

This information can really come in handy for small talk at user group parties; it's a lot more impressive to computer hobbyists than crushing a dozen aluminum beverage cans into your forehead.

Do You Need The Speed?

Under most transmission schemes in use today, it actually takes ten bits to send one character of data. Therefore, the approximate character transmission speeds of 300, 1200, and 2400 bps modems under optimal conditions are 30, 120, and 240 characters per second, respectively.

Is the extra cost of a medium- or high-speed modem a worthwhile investment for you? That depends on your telecomputing style.

Do you plan to make heavy use of commercial information services such as CompuServe, The Source, Delphi, or Dow Jones News/Retrieval? Since none of the commercial services offers 2400 bps service yet, spending big bucks on a 2400 bps modem is not a good bet. Why don't they offer 2400 bps service? Because there has to be a 2400 bps modem on both ends of the connection—yours and theirs. Since very few people own 2400 bps modems right now, information services wouldn't get much return on their investment in 2400 bps equipment while the price of the new technology is relatively high.

Besides, medium-speed 1200 bps units offer a very good price/performance value. However, you must balance the shorter connect times made possible by faster modems against any surcharges imposed on the higher transmission rates.

Here's a quick example. Suppose Steven J. is a frequent user of the Just Folks Information Service. Steve calls only during the evening (referred to as non-prime time by the commercial information services) and spends about five hours a month on Just Folks with his 300 bps modem. Assume that Just Folks' hourly charges are $7.75/hour for 300 bps, non-prime time access; plus a $3/hour surcharge for 1200 bps, non-prime time access. Steve's yearly cost for accessing Just Folks at 300 bps is:

$7.75/hour * 5 hours/month * 12 months/year = $465

If Steve upgraded to a 1200 bps modem, he'd reduce his yearly cost to:

$10.75/hour * 1.25 hours/month * 12 months/year = $161.25

The money Steve saves in a year would pay for a brand-new 1200 bps modem!

The Point Of Diminishing Returns

Admittedly, this is an ideal case. It assumes that armed with a 1200 bps modem, Steve will stay on-line only one quarter of the time that he would with his 300 bps unit. Depending on exactly what he's doing, the reduction may not be so dramatic, but under this rate structure a 1200 bps modem looks extremely attractive.

Now let's suppose that Just Folks decides to bite the bullet and support 2400 bps. Assume that to recoup its investment in the new equipment, the service tacks on an $8/hour surcharge for non-prime time 2400 bps access. Steven J.'s yearly bill would be:

$15.75/hour * .625 hours/month * 12 months = $118.13

Although upgrading from 300 to 1200 bps saved Steven about $300, the difference between 1200 and 2400 bps is only a little over $40 for the year! The key in this example is the additional surcharge for 2400 bps.

You can use this method to estimate your operating costs for accessing information services, computer-based bulletin board systems, or school computers. Just plug in the appropriate numbers for your intended use.

Hurry Up And Wait

The cost effectiveness of a medium- or high-speed modem also depends on how quickly the remote system responds to commands typed in from your computer. When the remote system is heavily loaded with users, slow response times are very common. In fact, if the system is very busy, a 1200 bps user can wait just as long as a 300 bps user for requests to be processed, and data may be transmitted to you in spurts rather than a continuous stream, lowering the effective transmission rate.

I've been logged onto some information services during the evening (8:00 p.m. to midnight Eastern Standard Time) at 1200 bps and have clocked effective transfer rates below 300 bps. In these cases, there's no advantage to 1200 bps—it actually costs more than using a low-speed unit for the same amount of data. A 2400 bps modem would be even more expensive overkill.

If you're a night owl, you'll find the best effective transmission speeds on the commercial services between 1:00 a.m. and 7:00 a.m. EST.

Response time is usually no problem on Bulletin Board Systems (BBSs). Since you are typically the only person using a BBS at any one time, the remote system can devote its full attention to you alone, so your transmission rate is preserved.

The Future Of 2400 Bps

Does the lack of support for 2400 bps bode ill for the acceptance of the new high-speed modems? While it certainly doesn't help matters, there is some hope for life in the fast lane.

Many 2400 bps modem manufacturers see the thousands of popular BBS systems run by hobbyists as the key. Since a BBS needs only one modem, the investment is more manageable by the individual or club operating the system.

Several of these manufacturers are reported to be working with the system operators of a number of popular bulletin boards to start a seed program for 2400 bps modems. By special arrangement, 2400 bps modems will be made available to selected system operators at prices very close to that of 1200 bps modems.

Industry-wide support of such a project would be welcome indeed. If significant numbers of bulletin boards support 2400 bps, it will provide a real incentive for everyone else to acquire high-speed modems. Since BBSs typically do not charge for connect time, it would cost users nothing extra to access them at 2400 bps. The only charges are for long-distance phone calls, and those charges are based only on the duration of the call. The additional cost of a 2400 bps modem can be recovered fairly quickly.

As the numbers of 2400 bps users grow, one of the major commercial information services will move to offer 2400 bps service and its competitors will quickly follow. The greater the perceived size of the 2400 bps market, the lower the extra 2400 bps surcharges will be.

Taking The Plunge

So we come to where the rubber meets the road. Should you spend the extra dollars today on a 2400 bps modem?

The economic case is weak at best. The short-term potential savings are low, considering the limited support of 2400 bps at this time.

On the other hand, computing, like cars, is a personal experience for many people. Critics can drone on and on for years about why it's inappropriate for humans to relate to machines. But it doesn't change the fact that driving down the road in a convertible with the wind in your hair and finding the last bug in a program are both kicks. Using a 2400 bps modem on good old regular phone lines is a lot like driving a Shelby AC Cobra with a 289 cubic-inch V-8. There may not be many places you can run flat out, but it can be a heck of a lot of fun when you do.

Two advantages of a 2400 bps modem over a Shelby Cobra: It costs about $60,000 less and you'll never get a speeding ticket.

BCNU.

Arlan R. Levitan
The Source: TCT987
CompuServe: 70675,463
Delphi: ARLANL

©

COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S̲.

If a number precedes a symbol, such as {5 RIGHT}, {6 S̲}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See	
{CLEAR}	ESC SHIFT <	↖	Clear Screen
{UP}	ESC CTRL -	↑	Cursor Up
{DOWN}	ESC CTRL =	↓	Cursor Down
{LEFT}	ESC CTRL +	←	Cursor Left
{RIGHT}	ESC CTRL *	→	Cursor Right
{BACK S}	ESC DELETE	◂	Backspace
{DELETE}	ESC CTRL DELETE	◨	Delete character
{INSERT}	ESC CTRL INSERT	◧	Insert character
{DEL LINE}	ESC SHIFT DELETE	⊟	Delete line
{INS LINE}	ESC SHIFT INSERT	⊞	Insert line
{TAB}	ESC TAB	▸	TAB key
{CLR TAB}	ESC CTRL TAB	◩	Clear tab
{SET TAB}	ESC SHIFT TAB	◪	Set tab stop
{BELL}	ESC CTRL 2	◳	Ring buzzer
{ESC}	ESC ESC	⬑	ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME	♥	{GRN}	CTRL 6	↑
{HOME}	CLR/HOME	S	{BLU}	CTRL 7	←
{UP}	SHIFT ↑ CRSR ↓	●	{YEL}	CTRL 8	π
{DOWN}	↑ CRSR ↓	Q	{F1}	f1	▔
{LEFT}	SHIFT ← CRSR →	▌	{F2}	f2	╮
{RIGHT}	← CRSR →	]	{F3}	f3	▁
{RVS}	CTRL 9	R	{F4}	f4	╰
{OFF}	CTRL 0	▁	{F5}	f5	▏
{BLK}	CTRL 1	■	{F6}	f6	╯
{WHT}	CTRL 2	E	{F7}	f7	▕
{RED}	CTRL 3	£	{F8}	f8	■
{CYN}	CTRL 4	◣	←	←	←
{PUR}	CTRL 5	▒	↑̲	SHIFT ↑	π

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP–RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP–RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10 SPACES}"
    :FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
    :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO10
    18:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE
    {SPACE}AN ERROR":PRINT"IN DATA STATEMEN
    TS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER A
    CTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POK
    E I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN
     DATA STATEMENTS.  CHECK TYPI
    NG.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER N
    OW ACTIVATED."
```

```
150 END
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

IBM Proofreader

```
10 'Automatic Proofreader Version 2.00 (
   Lines 270,510,515,517,620,630 changed
    from V1.0)
100 DIM L$(500),LNUM(500):COLOR 0,7,7:KE
    Y OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CHR
    $(70):ON KEY(15) GOSUB 640:KEY (15)
    ON:GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proofr
    eader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/W
    )-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34:
    POKE 1054,0:POKE 1055,79:POKE 1056,1
    3:POKE 1057,28:LINE INPUT L$:DEF SEG
    :IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$=MID$(L$,2
    ):GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3,
    1)=" " THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$(
    LNUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line numb
    er, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=L
    NUM(P) THEN GOSUB 560:GOTO 150 ELSE
    150
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(CK
    SUM+ASC(MID$(L$,I))*I) AND 255:NEXT:
    LOCATE Y,1:PRINT CHR$(65+CKSUM/16)+C
    HR$(65+(CKSUM AND 15))+" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P)
    =TEXT$:GOTO 150 'replace line
240 GOSUB 580:GOTO 150 'insert the line
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(MI
    D$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A>9
    6 AND A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," "):COMMAND$=
    TEXT$:ARG$="":IF DELIMITER THEN COMM
    AND$=LEFT$(TEXT$,DELIMITER-1):ARG$=M
    ID$(TEXT$,DELIMITER+1) ELSE DELIMITE
    R=INSTR(TEXT$,CHR$(34)):IF DELIMITER
     THEN COMMAND$=LEFT$(TEXT$,DELIMITER
    -1):ARG$=MID$(TEXT$,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOTO
     340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMIT
    ER=0 THEN LNUM=VAL(ARG$):GOSUB 540:F
    IRST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LAS
    T=VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=LA
    ST:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(X
    )),2)+" "
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(A
    $):CKSUM=(CKSUM+ASC(MID$(A$,I))*I) A
    ND 255:NEXT:A$=CHR$(65+CKSUM/16)+CHR
    $(65+(CKSUM AND 15))+" "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1:
    " FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:GO
    TO 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #1
    :ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
460 GOSUB 600:OPEN ARG$ FOR INPUT AS #1:
    MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:LN
    UM(P)=VAL(L$):L$(P)=MID$(L$,LEN(STR$
    (VAL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase
    program - Are you sure";L$:IF LEFT$(
    L$,1)="y" OR LEFT$(L$,1)="Y" THEN MA
    X=0:GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,0
    :ON ERROR GOTO 0:CLS:END
510 IF COMMAND$<>"FILES" THEN 520
515 IF ARG$="" THEN ARG$="A:" ELSE SEL=1
    :GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 130
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=P
    +1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LNU
    M(X+1):L$(X)=L$(X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:L
    NUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEXT:
    L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520
    ELSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG$
    =LEFT$(ARG$,LEN(ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".")=0 THEN
    ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"Stopped.":RE
    TURN 150
650 PRINT "Error #";ERR:RESUME 150
```

NEWS&PRODUCTS

Atari Printer Interface

Microbits Peripheral Products has announced MicroPrint and MPP-1150, printer interfaces that work on all Atari computers.

The MicroPrint is compatible with all software and connects to the computer's serial bus. A four-foot cable with Centronics plug is included.

Suggested retail price is $79.95.

Microbits Peripheral Products
225 Third Avenue SW
Albany, OR 97321

Commodore 64 Speech Synthesizer

Currah Technology has announced the *Voice Messenger-Speech 64,* a $49.95 speech synthesizer for the Commodore 64.

The unit plugs into the cartridge port of the 64, does not take any RAM from BASIC work space, and allows computing while talking. With built-in software, the *Voice Messenger* lets the computer talk immediately when powered up.

The system uses an allophone-based synthesizer chip which allows individual speech sounds to be strung together to make intelligible speech. The *Voice Messenger* is two and a half inches square and three-quarters of an inch deep. Its output is carried to the auxiliary 64 sound input and reproduced through the television or monitor speaker. Any word, sentence, or paragraph in English can be spoken. BASIC commands such as SAY and KOFF facilitate use. The *Voice Messenger* also allows the keys to talk individually as they are pressed.

Currah Technology
50 Milk Street
15th Floor
Boston, MA 02109

Apple, Atari, Commodore Strategy/ Adventure Games

Rails West!, a strategy game which simulates the development of the railway system in the United States, and *Questron,* a role-playing fantasy, are two new releases from Strategic Simulations, Inc.

Up to eight players can take part in the action of *Rails West!,* which might include starting a corporation; taking over existing companies; buying and selling stocks and bonds; applying for a loan; or floating securities.

The country's economic situation in the late 1800s, from boom times to panics, also is a factor in the game.

In *Questron,* the mission is to seek out the diabolical Wizard Mantor and take the Book of Evil Magic, thereby saving the Questron empire. Hordes of creatures and monsters unleashed by Mantor are waiting to defeat you as you wander through the land building character traits.

Questron, available on disk, retails for $39.95 for the Commodore 64 version. The Apple and Atari disk versions retail for $49.95. *Rails West!* retails for $39.95 on disk for Commodore 64, Apple, and Atari computers.

Strategic Simulations, Inc.
883 Stierlin Road, Building A-200
Mountain View, CA 94043-1983

Fantasy Game, Graphics Utility For Apple

Xyphus, a fantasy role-playing game, and *Cat Graphics,* a utility program, have been released for Apple computers by Penguin Software.

Xyphus is a series of scenarios with continuing characters, featuring four-player independent movement and a variety of spells. Each scenario takes several hours to play, and all are linked together in a larger game.

Play occurs in the world of Arroya. Goblins and forces of demonic magic are in control of Arroya, but anyone who can slay Xyphus will gain a kingdom within the continent.

Xyphus retails for $34.95 on disk.

Cat Graphics adds 55 new commands to Applesoft BASIC and is designed to make creating and using graphics on the Apple much easier. The same commands can be used for both standard (Apple II and II+) and double high-resolution graphics (Apple IIc and extended IIes).

There are 108 colors available in standard high resolution, and 256 in the double high-resolution mode. Using the graphics commands eliminates the need to do PEEKs, POKEs, and CALLs. Sound and other commands are also included.

New drawing commands include Curve, Fill, Magnify, Line, Flip, and Reflect, and other commands allow text display on the graphics screen.

In addition, the electronic kaleidoscope program *Electric Fire* is also included in the $34.95 retail price.

Penguin Software
830 4th Avenue
P.O. Box 311
Geneva, IL 60134

Atari Programming Aid

As an accompaniment to its ACTION! cartridge, Optimized Systems Software, Inc., has announced *The ACTION! ToolKit*, a programming enhancement for Atari computers.

Included are utilities which allow player/missile graphics, the use of floating point numbers in ACTION!, turtle graphics, dynamic runtime memory allocation, and advanced I/O operations. Demonstration programs also are included.

The ACTION! ToolKit is available on disk for $39.95.

Optimized Systems Software, Inc.
1221B Kentwood Avenue
San Jose, CA 95129

Apple II Graphics Printing Program

A graphics printing program, *Printographer*, by Roger Wagner Publishing, Inc., has been introduced for the Apple II line, including the Apple IIc.

The software is designed to print any low-resolution or high-resolution graphics pictures directly to the printer or to disk. It works with any of more than 50 printers, including the Apple Imagewriter and the Apple Scribe.

The *Printographer* also allows the addition of any of eight different type styles for labeling pictures, and allows magnification of pictures up to 99 times.

Printographer has a suggested retail price of $39.95 for all versions.

Roger Wagner Publishing, Inc.
10761 Woodside Avenue, Suite E
P.O. Box 582
Santee, CA 92071

Atari, Commodore Light Pen Graphics And Art Program

Futurehouse has announced *Peripheral Vision,* a graphics and art program for use with the Edumate Light Pen.

Features include 15 different colors and six brush stroke widths; printing capabilities; 35 different textures; fill mode; mirror mode for kaleidoscopic effects; and zooming for detailed work.

The program also will draw circles, squares, and triangles automatically; copy and move shapes around the screen; adjust the speed and accuracy of the light pen; and place keyboard characters on the screen.

Peripheral Vision is available on disk or cassette for the Commodore 64 and Atari 400/800 and XL series of computers. Suggested retail price is $39.95. A combination package which includes the Edumate Light Pen is available for $59.95.

Futurehouse
P.O. Box 3470
Chapel Hill, NC 27514

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication. ©

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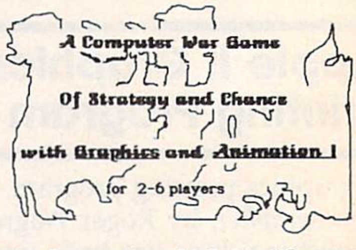

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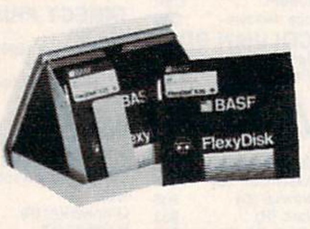

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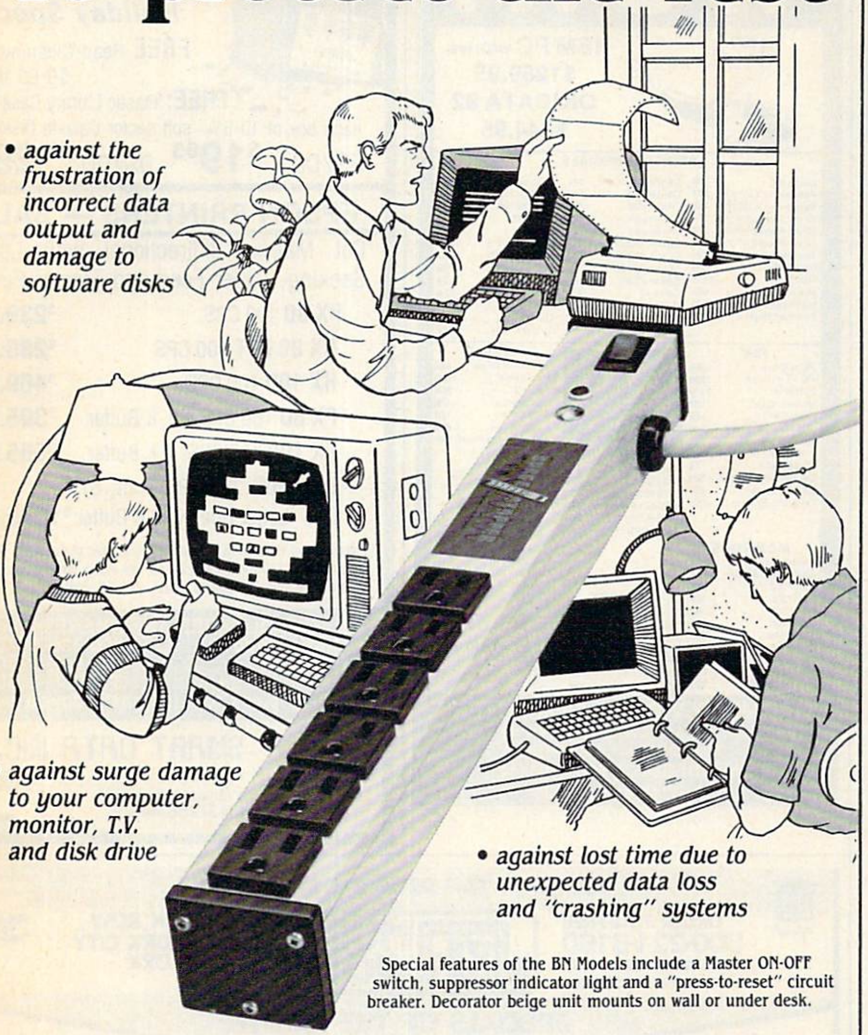

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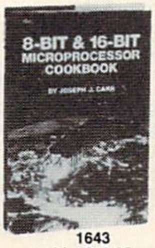
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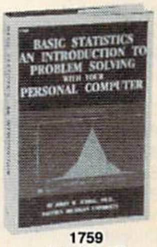
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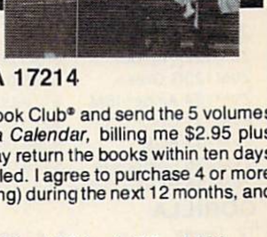
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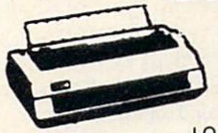

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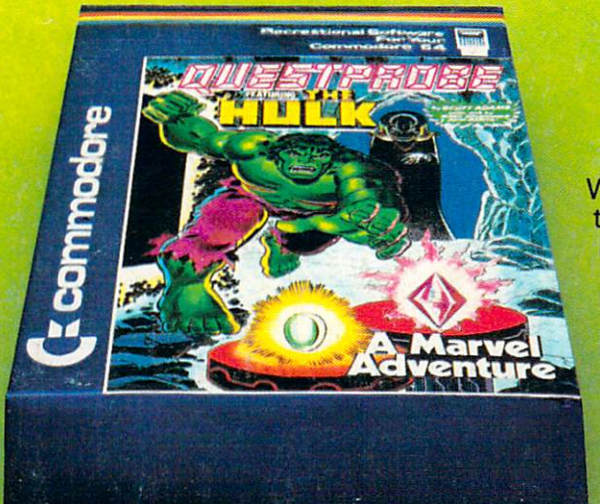

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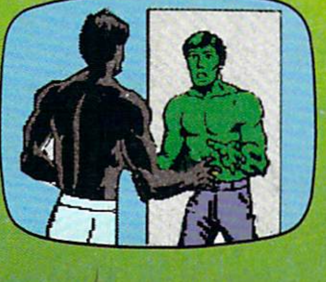

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